FEASIBILITY STUDY AND SUPPLEMENT

DEMONSTRATION MINE USING LONGWALL MINING TECHNIQUES

WINDBER / SOMERSET COUNTY / PENNSYLVANIA

U.S. DEPARTMENT OF COMMERCE
ECONOMIC DEVELOPMENT ADMINISTRATION

FEASIBILITY STUDY AND SUPPLEMENT

DEMONSTRATION MINE
USING
LONGWALL
MINING TECHNIQUES

WINDBER / SOMERSET COUNTY / PENNSYLVANIA

1966

U.S. DEPARTMENT OF COMMERCE
JOHN T. CONNOR, Secretary
Eugene P. Foley, Assistant Secretary
and Director of Economic Development

FOREWORD

Renewed interest in the 60-year-old longwall method of coal mining stems from the recent development of moveable, hydraulic roof supports.

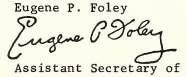
This study of experience with longwall mining techniques in a demonstration mine in Pennsylvania was prepared under contract by Allison L. Bayles and Associates for the Economic Development Administration's predecessor agency. The study is being published because --

-- it covers economic aspects of longwall mining not normally found in the writings of engineers and geologists;

-- it will be a valuable tool for libraries, schools of mining, and industrial consulting firms;

-- it will be of signal interest to the main industry in this country's number one redevelopment region, Appalachia.

Eugene P. Foley



Assistant Secretary of Commerce
and Director of Economic Development

ALLISON L. BAYLES & ASSOCIATES

CONSULTING ENGINEERS

PRODUCT EVALUATION
FEASIBILITY STUDIES
PLANT LAYOUT
MANAGEMENT
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14 October 1964

Mr. Frank A. Cirillo
Chief, Technical Projects Division
Area Redevelopment Administration
U. S. Department of Commerce
Washington, D. C. 20230

Reference: AF-30, Contract Cc-6114

Dear Mr. Cirillo:

It is a pleasure to transmit with this letter six copies of a report titled, "Feasibility Study - Demonstration Mine Using Longwall Mining Techniques, Windber, Somerset County, Pennsylvania".

This report is offered as the PRELIMINARY REPORT prescribed under Article I, Section D, Subsection 2, and as the INTERIM REPORT prescribed under Article I, Section D, Subsection 3, of the referenced contract.

The consulting engineers have attempted to make the report complete in itself. Since longwall mining with powered roof supports is a relatively new art there may be areas which appear obscure or terms which may be confusing to those who examine it. We shall welcome the opportunity to clarify them.

It has been and is a pleasure to work with your associates and yourself. We thank you for your cooperation and hope for your continued interest to achieve fruition of this project.

With every good wish, we are

Faithfully yours,

Allison L. Bayles & Associates

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8 June 1965

Mr. Frank A. Cirillo, Chief
Technical Projects Division
Office of Program Development
Area Redevelopment Administration
U. S. Department of Commerce
Washington 25, D. C.

Reference: AF-30, Contract Cc-6114

Dear Mr. Cirillo:

It is a pleasure to receive your letter of 4 June 1965, advising us that our report titled, "Feasibility Study-Demonstration Mine Using Longwall Mining Techniques, Windber, Somerset County, Pennsylvania", transmitted with our letter of 14 October 1964, and the Supplement to the Feasibility Study, transmitted with our letter of 1 April 1965, are acceptable as the complete report required under the subject contract. Accordingly, we have incorporated the substance of the foregoing two papers into one report which is transmitted with this letter.

We devoutly wish that this study should result in an effective improvement in the economic conditions of Somerset County and shall continue our efforts toward this end.

It has continued to be a pleasure to work with your associates and yourself. We thank you for your cooperation. We shall hope for your continued interest, and we commend the Administration on its foresight in making such studies possible for the benefit of our citizenry.

With every good wish, we are

Faithfully yours,

Allison L. Bayles & Associates

Allison L. Bayles & Associates

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Drawings - Proposed Demonstration Mine East of Windber, Pennsylvania

Introduction

This report contains the results of a feasibility study of a projected Demonstration Mine to be located east of Windber, Pennsylvania on the outskirts of that city. The idea of such a mine was inspired by the desire to relieve the depressed condition of the coal industry in Central Pennsylvania. The solution seemed to lie in finding and applying a method of mining the thin seams of the area profitably. The consulting engineers felt that longwall mining with caving using powered roof supports might hold the key. It had revitalized the coal mining industry in the United Kingdom in a relatively short period.

Accordingly, an approach was made to Dr. H. B. Charmbury, Secretary of the Department of Mines and Minerals of the Commonwealth of Pennsylvania, to ascertain his reaction. It was favorable subject to endorsement by the Bureau of Mines. The latter expressed favorable interest and the Area Redevelopment Administration was approached to ascertain its attitude. It, too, was receptive.

Preliminary reconnaissance indicated Somerset County as a location and a property was located east of Windber, Pennsylvania, which seemed to satisfy conditions. The sponsorship of the Somerset County Development Council and the Community Development Council of Windber was sought and granted heartily by them.

The Area Redevelopment Administration entrusted the Consulting Engineers with the task of preparing a feasibility study which would include but not be limited to the following accomplishments.

Preliminary Investigation - Study the strata and seam characteristics in adjoining mines and consult with experienced operators of the same seam in the area to back up preliminary findings which were limited to the study of core drill data and highwall observations. - Take channel samples along the highwall and have a washability study made to determine the amount and type of cleaning necessary to meet the proposed market requirements.

Select the seam and area for the second installation and study the strata and seam characteristics in order that the face equipment can be designed for both mining conditions.

1. Obtain options on the surface and coal.

2. Carry through the market survey to assure outlets for the product of this operation and secure commitments for the output.

3. Make surface surveys, surface and mine layouts, detailed plans and specification for mine, preparation plant, storage and rapid loading facilities, select equipment, prepare a definitive estimate of capital expenditures and prepare a projection of operating costs.

4. Select a coal company to operate the project through the first and second installations.

5. Prepare progress reports, a preliminary draft, a report on the trip (to the United Kingdom) and a final report.

6. Inspection of facilities in the United Kingdom.

The work was authorized on 20 December 1963.

The substance of this report which follows purports to satisfy the foregoing areas of inquiry. Perspective and depth of judgment have been enhanced by two additional

extended inspection trips to the United Kingdom and Western Europe by Mr. M. Albert Evans in connection with investigations on longwall mining techniques and equipment.

The selection of a mining operator has been made, who has reserves near the first property adequate and suitable to support a second location. At this stage the project is being investigated and a plan of financing is being developed. These aspects do not affect feasibility and are omitted from this paper.

Coal Property

The area of "C'" seam chosen earlier for the initial operation has been optioned, together with necessary surface, and has been studied for (1) local seam characteristics, (2) character and depth of overburden, (3) seam quality and washability, (4) recoverable tonnage, (5) surface details and contours, (6) accessibility, (7) transportation to and for trainload shipments, (8) adaptability to the project and for mining with the longwall technique and (9) low cost of development.

The property adjoins the Borough of Windber on the surface and underground The Berwind-White Coal Mining Company's #35 Mine, of which it was originally a part. A sandstone replacement crossing the #35 Mine in a Northeast direction isolated the coal between this barren strip and the outcrop and made it impractical to mine the coal from #35. Otherwise the coal would have been mined out before this time.

The barren strip maintained a wavy but fairly uniform line across the #35 Mine, so it is reasonable to assume that the characteristics of the replacement will be similar on its Southeast side. The area has been core drilled and has also been exposed on three sides beyond the fault by stripping.

Option

In order to have permission to make a thorough study of the property and be assured it would be available, an option-lease

was requested from The Wilmore Coal Company, Windber, Pennsylvania, the land company of the property owner, The Berwind-White Coal Mining Company, Philadelphia, Pennsylvania. We were advised there would be complete cooperation and to proceed with our investigation and determine the surface requirements so that the papers could be prepared. Later, after the surveys were made and surface needs submitted, our attorney, at the request of Wilmore, prepared an outline for such a document and, in addition, advised on general terms for the protection of the lessee. This was completed and handed to the Wilmore representative, who drew up an option-lease and presented it to his superiors in Philadelphia. It was at this late date that the question arose as to whether any lease was desirable at this time. After a period of better than two months the problems were finally resolved and a favorable option-lease was forwarded for signatures.

The option-lease, extending to October 31, 1964, has been executed by the Somerset County Development Council and The Community Development Association of Windber, as lessees, and The Berwind-White Coal Mining Company, as lessor. The agreement is made to the lessees, or Their Nominee, subject to the approval of Berwind-White. A copy of the option-lease is made a part of this report as Exhibit I. A request has been made for an extension to December 31, 1964, and we have some encouragement that it will be granted.

Seam Characteristics - General

General characteristics of the "C'" seam in the area

were discussed with mining men in the Windber area, including Mr. D. Edwin Eakins, present superintendent of Vulcan Coal Company's Mine #40 (old Berwind-White property). He was recommended as one of the best informed men on the "C'" seam in the Windber area.

Mr. Eakins advised that around Windber the "C'" seam conditions are fairly uniform. Entries can be driven twenty feet wide, but usually are sixteen feet because of equipment limitations. Rooms are driven 23 to 35 feet wide. In both instances, the characteristic bone and rash over the coal can normally be held when the coal is extracted with a continuous miner. The coal seam is not grown into the bone and rash and is free from them.

Normal room centers are 60 feet, and in removing the pillars the rash does not crumble. In establishing a butt entry pillar line, the first fall comes at a maximum distance of approximately 150 feet. The roof is fairly easy to control, even under thin cover. Roof conditions would be normal 100 feet inby a highwall, or 70 feet of cover.

The seam floor is normally hard, but will soften with water. There is little water following pillar falls. However, the seam dips uniformly with very few rolls so that water does not lay in swags. For these reasons, it is not difficult to project for gravity flow away from most of the work.

The seam thickness is fairly uniform, varying gradually over an extended area. The coal is of a soft nature and hardness increases with the percentage of impurities. Therefore, the plus 3/4 inch coal is higher in ash and sulphur. Rejects are heavy with sulphur and fire rapidly.

The conditions combine to make high production possible with the continuous mining type of equipment. Mr. Eakins has records (not averages) up to 875 tons of raw coal, or 500 tons of clean coal where the rash was mined in a full seam continuous miner operation.

Seam Characteristics - Underground Observations

The unmined pillars of the #35 Mine are being retreated by the Dell Coal Company. This operation, as stated above, is separated from the proposed area by only a sandstone replacement of about 2,500 feet in width. Therefore, conditions should be similar, and for that reason the mine was visited and underground details studied carefully.

Pillars have been retreated to 5 Right Butt entry, which allowed a substantial area of standing pillars for observation. There were very few falls in the first mining of some years ago, even though rooms are wide (50') and room pillars comparatively narrow (30'), timbering skimpy and rotted out. Entries had been driven 12 feet wide and the full seam taken, but the rash had been left in place in roomnecks and rooms. The bone had been taken with the coal. The rash had caved in these narrow (12') roomnecks, but was intact in the wide rooms. The reason is possibly due to more concentrated coal blasting effects in the narrow work.

The seam in gradient and thickness was fairly uniform, dipping at about 2% to the Northwest and varying gradually in thickness from 45 to 60 inches. The rash and bone were fairly consistent at about 12 inches and one inch, respectively, except in one small area it was noted that the rash had turned into rock.

When the sandstone replacement was encountered it was abrupt, with the seam dropping to a few inches in a matter of ten feet or so. The line of this replacement had a wavy nature but was consistent in direction.

The bottom was hard with the exception of a few places where it was wet. Water flows away from the remaining pillars by gravity and very little was observed.

The roof above the coal is a strong shale and remains good even with as low as 50 feet of cover. No evidence in either appearance or behavior could be seen in the roof or bottom from mined out "B" seam 100 feet below. The operators were not experiencing any problems from this source.

The second mining was being done with undercutting and shooting, with holes extended into the bone so as to bring down the rash, and then hand loaded. The entry pillars and room stumps were recovered by driving through lengthwise and slabbing back. This left about eight feet of coal. The room pillars were recovered by further widening the 50 foot rooms until all but about ten feet were removed. The caves appeared to be weight-relieving.

The roof has to have unusually high tensile strength to permit wide expanses to stand for so long after first mining and then be submitted to this method of pillar recovery. This is recognized; therefore, the weight-relieving falls with partial mining under this strong roof can only be explained in that the "B" seam caving has resulted in incipient fractures forming in the upper measures.

It was noted in rooms at the edge of pillar caves that

posts broke without breaking the rash over them. The rash, however, showed cracks in a few places.

Coal cleats are not strong and are on an angle to the horizontal rather than vertical planes. Again, the latter may be due to "B" seam mining.

The seam contained a bone parting about 30 inches from the bottom. This and the rash and top bone were being loaded, picking out some of the top rock. The resultant raw product was in excess of 9% ash, but the operators felt that by selective mining they could hold 9% without cleaning. The mine is non gaseous.

Seam Characteristics - Observations Along Highwall

The proposed area has been stripped on three sides, exposing the seam and the strata which would make up the shelf in a longwall operation. An 800 foot length on the East side was not stripped because of a hard bed of sandy shale at that location.

The highwall was studied in detail. The bottom had remained hard after exposure to the elements for a year or more. There was very little sluffing of the seam or measures above from oxidation and no fall-outs of any consequence. The seam had a uniform dip with no rolls and maintained a reasonably uniform thickness varying from 43 to 49 inches. The bone near the middle of the seam changed from 3/8 inch to two thin partings totaling two inches to a thickness of five inches.

The top bone also changed in thickness from 3/4 inch to five inches, but the increase usually resulted in a reduction of thickness of rash.

The strata over the coal were bedded and fissured.

The latter could have come from blasting or from the mining of the "B" seam. At one location a relatively recent normal fault with a three-inch offset showed up in the coal, definitely due to "B" seam mining.

Mr. Franklin Miller, Mining Engineer for Berwind-White Coal Mining Company, has assured that mining in the "B" seam has been clean. In the later mining of the "C'" seam the only ill effects encountered were in passing over barrier and chain pillars which had been left in the "B" seam for a purpose.

Seam Characteristics - Core Drill Studies

A total of six core drill records of the strata and coal with analyses of the seam and five core drill records of the seam only with analyses were made available by the Wilmore Coal Company.

This information, together with highwall sections and analyses made at a later date, are shown in section on Drawing C-10-33 - Strata and Seam Data, a part of this report. The highwall sections are limited to 2,400 feet along the Southeastern side, due to some backfilling which took place between the first study and the time of the measurements. The backfilling has been discontinued.

The core drilling and prospect records of seam and strata, illustrated in Drawing C-10-33 - Strata and Seam Data, assure a continuity of normal "C'" mining conditions, other than the small area in the Southeast in and around the locations where stripping was discontinued. They disclose natural bed separations. Good longwall practice under conditions in the Appalachian Field

requires that the beds to be caved be at least three times the thickness of the seam to be removed. In certain areas it may be necessary to go as high as 27 feet above the seam to reach a normal bedding plane meeting the above conditions.

The core drilling further discloses that the seam thickness will range from 43 inches to 48 inches with little variation in the analysis of the coal below the bone. Selective mining would produce a raw product of approximately 10% ash. The bottom is strong.

An effort was made to determine the normal caving height in the initial fall when starting off new pillar lines as an assist in determining expected shelf thickness for longwall mining. This was not available, but it was determined that the first cave occurred at a maximum of 140 feet on a 240 foot face. If we assume that the sandy shale, common to the area, has a tensile strength half-way between a strong and weak sandstone, then, using this in calculating the thickness of the breaking strata by the fixed beam formula, we determine the thickness at a maximum of 25 feet. This is close to the 27 feet determined from the core drilling as the thickest natural beam section.

Character and Depth of Overburden

The strata along the highwall were relatively thin bedded, but the core drilling indicates a definite change toward thick sandy shale to the North. This would give concern under the extremely light cover if it were not for the fracturing which has taken place following the mining of the "B" seam. Core drilling can only show trends. However, the good pillaring conditions normal to the "C'" do indicate that, while the strata are strong, they have

a bedded characteristic which assists in caving.

By transposing enlarged geologic survey maps, depth of cover has been determined as 220 feet maximum.

At 90 feet above the "C'" seam, the "E" seam is being stripped, and much of the area can be stripped, indicating that most of the cover does not exceed 150 feet.

A survey was made along a small stream bed at the Southwest end of the property to determine definitely the cover along that stream. This influenced the projection of the first panel. Elsewhere, water courses are so small that they have no significance.

Seam Quality and Washability Studies

The bone parting in the seam brings the ash content to 10% even with selective mining. Therefore, some cleaning will be necessary.

Cleaning plant records from Berwind #40, "C'" seam, were made available by The Berwind-White Coal Mining Company. These covered daily data from November 1959 through September 1960, and special tests during 1958 for mining under the bone, full seam mining with Joy Continuous Miner and full seam mining with a bottom cutter. A summary of these tests is displayed on Page 10.

The cleaning facilities included hand picking the plus 5", washing the 5" x 1/2" in a Chance Cone, washing the 1/2" x 1/4" in a Hydrotator, air cleaning the 1/4" x 0. The 1/4" x 14 Mesh middlings from the air tables were recleaned in the Hydrotator and the 14 Mesh x 0 in a Classifier. The 2 mm size from the Hydrotator was also cleaned in the Classifier.

The air tables did a good job, reducing a raw product

"C'" Cleaning Plant Tests - #40 Mine (1958)

	Mining Under Bone (1)			Full Seam Mining								
	Test A-2 9/26 N(2)			Test B-1 10/9 D(3)			C 10/15D(4)		D 10/16D(5)		E 10/17D(6)	
	Pct.	A	S	Pct.	A	S	A	S	A	S	A	S
Cleaned Coal+	81.25	8.12	1.19	84.44	8.78	1.28	9.43	1.44	8.25	1.22	8.82	1.42
H.Picked Bone+5"	0.55	13.50	2.78	0.48	16.99	3.75	-	-	-	-	-	-
Comm.& B.Coal	81.80	8.16	1.20	84.92	8.83	1.29	-	-	-	-	-	-
H.Picked Ref.	2.00	70.00	2.00	2.00	70.00	2.00	-	-	-	-	-	-
Cl.Plant Rej.	16.20	39.97	5.80	13.08	41.67	6.72	-	-	-	-	?	?
Raw ROM	100.00	14.55	1.96	100.00	14.35	2.01	-	-	-	-	17.58	2.79
Hydrotator 1/2"x2MM*												
Clean Coal		8.13	1.13		8.97	1.19	8.47	1.05	8.30	1.07	9.24	1.32
Rejects		47.34	6.69		56.89	8.20	49.70	6.88	54.49	6.96	57.98	9.68
Classifier -10M**												
Clean Coal		4.66	0.68		5.81	0.79	5.93	0.78	5.42	0.79	5.86	0.82
Rejects		23.64	5.09		55.98	12.76	35.38	6.93	27.01	4.74	50.34	12.82
AirFlow Clean Coal 1/4"xO												
Box 1		7.97	1.18		8.12	1.13	8.71	1.28	8.18	1.10	8.10	1.24
Box 2		7.71	1.11		8.27	1.15	8.75	1.27	8.10	1.17	8.47	1.22
Box 3		7.70	1.09		8.10	1.11	8.51	1.20	7.70	1.17	8.15	1.24
Average		7.79	1.13		8.16	1.13	8.66	1.25	7.99	1.15	8.24	1.23

\+ Includes Chance Cone 5"x⅜"
* ⅜"x¼" Raw and ¼"x10M Middlings
** Minus 10M Middlings and Minus 2 MM from Hydro
(1) Mining Under Bone to fullest extent practicable, Full Shift
(2) A-1 Test discounted acc't. cl. unit breakdowns and clean out
(3) Full Seam Mining Bottom Cut, Full Shift
(4) Joy Continuous Miner Coal Only, approx. 600 tons raw ROM
(5) Full Seam Mining Top Cutting, Full Plant Shift
(6) Joy Cont. Miner Coal Only, raw ROM sampled, 800 tons raw

ranging from 11.52% to 12.31% ash and 2.46% to 2.29% sulphur to ranges of 9.2% to 8.46% ash and 1.57% to 1.18% sulphur. However, it was quite evident from the difference in analyses between raw product and core drill and channel samples that, as is normal, the mobile loaders and continuous miners were contaminating the product with top and bottom. The analyses obtained with hand loading at Dell Coal Co. verified this.

The longwall shearer working from the top of the face conveyor pan line, on the other hand, is easier to control. Mining being limited to the coal rather than taking the full seam also would change conditions. Further, the seam changes in itself over a distance.

In light of this, careful channel samples were taken along the exposed highwall, covering a distance of about 3,200 feet, to determine what could be expected by mining the coal seam only. The coal was all crushed to go through 3/4 inch round holes, the minus 20 Mesh removed (An air plant gives little or no cleaning to minus 20 Mesh except for heavy sulphur), and a float and sink study made at 1.60 gravity, an air plant cleaning limit. The float plus 20 Mesh product and raw minus 20 Mesh were combined and a complete analysis made. Warner Laboratories, Inc., Cresson, Pennsylvania, performed the washability studies. Their report is appended as Exhibit II. A summary follows:

	Plus 20 Mesh Raw			Minus 20 Mesh Raw		
	%	% Ash	% Sul.	%	% Ash	% Sul.
Top Rash					10.25	2.34
Top Bone	20.0	20.59	3.60		17.96	1.86
Seam to be mined	87.6	9.92	2.15	12.4	8.29	2.30

	Plus 20 Mesh					
	Float at 1.60			Sink at 1.60		
	%	Ash	% Sul.	%	Ash	% Sul.
Top Rash Top Bone	73.2	- 9.5	2.29	26.8	- 50.88	7.18
Portion of Seam to be mined	94.47	7.71	1.01	5.53	47.57	21.61

Portion of Seam to be Mined - Composite of Plus 20 Mesh Float and Minus 20 Mesh Raw

	As Received	Dry Basis
% Moisture	0.98	-
% Volatile Matter	15.57	15.72
% Fixed Carbon	75.63	76.38
% Ash	7.82	7.90
	100.00	100.00
% Sulphur	1.20	1.21
B.t.u.	14,160	14,300
B.t.u. (Moisture & Ash Free)		15,527

Fusing Temperature of Ash 2780° F.

Coke Button Index A.S.T.M. No. 3½

Grindability (Hardgrove Index) 103

The coke button results should be ignored as the coal had been exposed to the weather for some time.

The screening results show an exceptionally high percentage of the plus 20 Mesh material available for cleaning and indicates that satisfactory results can be obtained by cleaning with air tables, if mining is limited to the portion of the seam below the rash and top bone. The coal will have to be crushed to 3/4 inch as a maximum for this type of equipment. To simplify

crushing and screening and at the same time remove some of the bone parting and sulphur lenses without crushing, a Bradford Breaker with 3/4 inch round holes is proposed for installation ahead of the air cleaning units.

We will assume that in mining we will pick up one per cent additional impurities. In this instance it is assumed it would be rash and bone. This will change the raw product as follows:

	In Channel		Expected Mined Product	
	% Ash	% Sul.	% Ash	% Sul.
Minus 20 Mesh Raw Coal	8.29	2.30	8.42	2.34
Plus 20 Mesh Raw Coal	9.92	2.15	10.29	2.35

In cleaning in the air tables, there will be a loss of coal with the table refuse, which will affect the final results. The percentage of rejects is so small, however, that 30% coal loss is suggested in this instance.

Removed and Lost in Cleaning	%	% Ash	% Sul.
Plus 20 Mesh			
Bradford Breaker	1.0	40.00	3.60
Air Tables - Refuse	3.7	47.57	21.61
Air Tables - Coal	1.6	7.71	1.01
	6.3		
Minus 20 Mesh			
Air Tables (Sulphur Only)	2.3	21.61	21.61
Total Weighted Average of Rejects	5.8		

Expected clean coal results from removal of above:

	%	% Ash	% Sul.
Raw Plus 20 Mesh	100.0	10.29	2.35
Clean Plus 20 Mesh	93.7	8.55	1.56
Combining			
Plus 20 Mesh Clean Coal	82.0	8.55	1.56
Minus 20 Mesh Raw Coal	12.4	7.79	1.80
Reassembled Product	94.4	8.45	1.59

Analysis

	% Calculated	% Expected
Ash	8.45	8.50
Volatile Matter	15.61	15.60
Fixed Carbon	75.94	75.90
	100.00	100.00
Sulphur	1.59	1.60
B.t.u. (Dry Basis)	14,220	14,200
B.t.u. (Moisture & Ash Free)	15,527	
Fusion Temperature of Ash		2500° F.
Grindability	103	

Recoverable Tonnage

The thickness of the coal has been determined to range from 43 inches to 48 inches, and two shearer drum sizes best adapted to the seam have been chosen for the longwall work. One of these will cut a height of 44 inches and the other 41 inches, with an average of 43 inches. The development work, with the 52 inch clearance required in the tail stable, will average 47 inches in height.

It has been determined from the projection, shown on Drawing C-10-34 - Projection C' Seam, and later discussed in detail, that the shape of the coal reserves permits three longwall panels, two with 600 foot faces totaling 8,000 feet and one of which will have an extension for a narrower face (295 feet by 500 feet long); and one 595 foot face 4,000 feet in length.

The four development butt entries for these faces total 18,600 feet. Three of them would be comprised of one 17 foot, one 18 foot and one 22 foot entries and the fourth, two 18 foot and one 17 foot entries. The connecting, or starting, rooms total 1,795 feet between entries and the stop rooms the same.

There is an area to the Southeast which is too small and conditions too questionable for longwall work. The room and pillar system is recommended for this corner.

The total recoverable raw coal, based on the above, is:

Longwall Panels

12,000 feet - Longwall Panels	1,050,000 Tons
18,600 feet - Development Butt Entries	180,000 Tons
3,590 feet - Connecting Rooms	20,000 Tons
Total Recoverable Raw Coal	1,250,000 Tons
Total Recoverable Clean Coal with 94% Recovery	1,175,000 Tons

Area Limited to Room and Pillar Mining

Recoverable Raw Coal in Block	60,000 Tons
Recoverable Clean Coal	55,000 Tons
Total Recoverable Clean Coal from Lease	1,230,000 Tons

Surface Detail and Contours - Drawing C-10-39 - Surface Layout

The coal seam is located about 140 feet in elevation above the macadam road leading to Windber and the Windber Branch of The Pennsylvania Railroad. Before projecting the mine and laying out the surface plant, it was necessary to make a topographic survey to establish horizontal and vertical relationship between the coal seam and other important physical features. This included the coal face on the stripped highwall, the railroad, roads, adverse property lines in the area, power and water lines.

The work was done and the information plotted on 100 foot scale maps. These prints are too bulky to include in the report but the information derived from them has been used in preparing the basic data for the various drawings appended.

Accessibility

With regard to accessibility, the objective is a central point in the area at a location with large siding facilities which can easily be reached by good highways, a limited distance from the highway and having a minimum of underground travel.

The proposed property meets all these conditions. It is in the northern part of Somerset County, the initial opening within 1,400 feet of a proposed plant site on a large railroad siding; is less than a mile from the center of the Town of Windber by way of a good macadam highway; has only one-half mile of dirt road to the mine openings. With each butt entry opening off the highwall, there could be no closer access to the working face. Drawing C-10-34 - Projection C' Seam illustrates most of the above.

Continuous Transportation to Trainload Shipment Facilities

The distance and topography between the mine portal and the preparation, storage and loading facilities lend themselves to belt transportation.

This is shown in plan and profile on the Surface Layout, Drawing C-10-39. Very little gradework will be necessary for installing a 1,425 foot 30 inch belt conveyor from a loading feeder bin at the end of the underground belt to an 800 ton surge silo near the cleaning plant. Transportation distance from the bin

to the Bradford Breaker and air plant is minimum. The belts from the air plant to the 4,000 ton storage pile, and from there to the pantleg chute over double railroad tracks are not minimum but the distances are relatively short.

The railroad siding was shortened by final terms of the option-lease, making it necessary to extend the double track a distance of 1,060 feet (See Drawing C-10-32 - Surface Plant Showing Proposed Siding Extension). This anticipated a satisfactory arrangement for crossing a small surface outstanding ownership (See Drawing A-1-32 - R-O-W. Across McQuaide Surface). Otherwise another 150 feet must be added to the siding.

Cross sections for fill determinations and drainage requirements for the extended siding sub grade were made in order to get contract prices for the extension.

Adaptability to the Project and For Mining With The Longwall System

The proposed coal property has the necessary reserves for the two-year period of operation. It is reasonably close to the railroad siding facilities. The topography is adaptable to the surface plant requirements. The location is central for the area and readily accessible for visitors. The coal is inherently a good utility fuel and can be cleaned with a minimum of investment and loss in refuse. The largest reserves in Somerset County are in the "C'" seam. The seam thickness to be mined is close to the average of Central Pennsylvania coal reserves to be mined in the next decade. The seam has ideal conditions for high

productivity with a continuous type loading machine. Finally, opening the mine and getting into production can be accomplished with minimum cost.

Strata and seam conditions are favorable for the long-wall system of mining. The bottom is firm and without undulations. The rash is strong and should act as a cushion against shock when resetting the supports after advancement. There is a question, however, as to whether or not the bone between the coal and the rash can be held when the head coal, which will act as a mat, gets as thin as an inch or so. Should that problem develop, there are two solutions: (1) raise the seam horizon and cut out the bone or (2) maintain the horizon by getting a larger cutting drum and, if necessary, extensions for the support legs.

The roof is strong but caveable with weight-relieving falls. Mining and caving of the "B" seam, 100 feet below, have caused the formation of incipient cleavage planes in the strata above the "C'" seam which will offset the expected lack of abutment pressure fractures due to limited cover.

Shelf thickness, calculated from initial caving information and by the fixed beam formula, using a maximum span of 150 feet with a width of 240 feet, is determined to be between 19 and 20 feet. An ultimate strength of 600 pounds per square inch was used for the roof material. While the roof is strong, this figure probably is high, as was anticipated earlier in this report and is borne out by core drill records showing as high as 27 feet to the first normal bed separation above three times the seam thickness.

Using the 27 feet as the expected maximum shelf thickness

and a shelf length of 19.7 feet, which anticipates a cave with each support advance and a 60 degree roof fracture, then assuming the shelf to be a supported cantilever, by the Theorem of Three Moments a support having a yield strength of 49 tons per lineal foot is required. Of this, 80%, or 39 tons per lineal foot, must be located in the waste edge support (middle and rear legs). Should the assumption that a cave will occur with each support advance be wrong and a cave comes only with every second advance of the supports, then the shelf length would be 21.9 feet, requiring 60 tons per lineal foot, or approximately 48 tons per foot of waste edge support per lineal foot of face.

Standard powered supports for the latter severe yield requirements are available in the seam range desired.

There was a successful longwall operation in the "C" seam a few miles from the proposed site during the 1920's. A waste edge support of 50 tons per foot of face was used, but no records are available to determine whether or not that support intensity was ever needed. The stronger base support now available would reduce the per foot requirements of the earlier rigid jacks set on wood sills.

The variable consist of the top rash and bone, as well as the high ash of the float 1.60 of this portion of the seam even under normal conditions, makes it most desirable to limit mining to the portion of the seam under the top bone. Below this is a parting of bone about a foot from the top bone and sulphur lenses to be removed in cleaning.

Seam conditions are satisfactory for mining with either a plough or a positive action type longwall continuous machine.

A plough would mean more contamination of the coal, particularly from the top bone. Also, encouraging roof pressure to increase loadability might also bring down the rash. Most important, it is the intent to prove equipment which could be used in many seams rather than a special condition. Therefore, a positive action coal getting unit is most desirable. There is a variation in seam thickness, but the change is gradual. A ranging shearer is not available for seams of this thickness, but an Anderton Shearer with a special drum and cowl for bi-directional cutting is the simplest and, in this instance, probably the most productive unit available. Two sizes of drums and cowls can be used, changing from the larger to the smaller as the seam reduces in thickness.

A Bi-directional Shearer will give a smaller size consist than a plough. However, the large proportion of plus 20 Mesh size, as determined in a washability test made from coal obtained at the proposed location by channel samples, indicates no cleaning problem from size source. The size consist of any sample obtained by hand channeling with a pick is undoubtedly smaller than any positive acting longwall coal getting unit, with the possible exception of a milling type machine.

Low Cost of Development

The established highwall allows immediate access to saleable coal under supportable roof. It is expected that normal roof conditions will be found at 50 feet of cover and beyond the influence of any highwall blasting, or about 100 feet inby the portal. Therefore, the longwall faces can be placed in operation within six months after the mine is started.

The raw product, during the development period and while the surface plant is being constructed, can be trucked about 7,000 feet to a presently operating ramp to be sold as an inferior fuel, or can be stored until the preparation and storage facilities are available. The economics would have to be determined. In either instance, the early accessibility to full production and the saleable coal produced during that period would work toward reducing development costs.

Underground Projection

The general underground projection is shown on Drawing C-10-34 - Projection C' Seam (scale 1" = 400'), and the details of it on Drawing C-10-38 - Mining Plan (scale 1" = 100'). In preparing them, all basic information was placed on the drawing, including the strip mining, auger drilling, adjoining small mine, core drill holes and channel locations with seam sections, coal contours, railroad tracks, roads, streams and property lines. Then the Southeast side of the barren area, or sandstone replacement, was plotted parallel to the Northwest side established by actual contact in the #35 Mine. It will be necessary to core drill the seam prior to mining, as shown on the projection, so as to be certain the Southeast side is within the boundaries indicated.

The tract lends itself to advancing faces. The front of the property is nearest to the railroad siding. The closest point is also the lowest in elevation with the dip to the Southwest. Weight-relieving falls with partial mining, as observed in #35 Mine, assure that there will be no weight carryover into the

entries. Excessive water in pillaring is not characteristic of the seam, but the cover is so light that it would be a serious gamble to ignore it. Gas is no problem, so ventilation can be handled on the advance mining without additional precautions.

The Butt entry system parallels the sandstone replacement. The minimum number of butt entries to meet requirements and on the closest safe centers is used to speed the advance of development and reduce coal loss to a minimum if the entry pillars are not recovered. In each butt, the entry to be used as a tail stable is to be driven 22 feet wide, the head stable 18 feet wide and the center 17 feet wide. Therefore, since the number 3 Butt may be used as the head stable for both #2 and #3 panels, the two outside entries will be 18 feet and the center 17 feet in width.

It is the intent to drive the butt entries as the face moves forward, keeping them 500 to 600 feet in advance, as shown in detail on Drawing C-10-35 - Underground Equipment. For the first panel, it will be necessary to drive two sets of butt entries ahead of the face. After the first panel only one will be necessary.

The longwall advances between two sets of butt entries, starting from a room driven between them. Two places are necessary for this starting point, one for the equipment and the other for ventilation during the driving process and later as a haulroad for equipment and, finally, as a bleeder. The starting room must be straight and, if the roof permits, sufficiently wide to allow a roadway behind the equipment.

The most ideal length of face for this seam thickness

is between 700 and 800 feet. Physical factors, however, limit the face length at this property to 600 feet. This is far beyond the minimum for roof control. It is long enough to keep stable delays from being a serious handicap, permits a substantial production within the limitations of the advancing speed of the development and is the maximum length under the physical limitations to hold the number of panels to a minimum for moving costs.

The entries at the ends of the longface form the necessary stables to house the face conveyor drives, the stage loader, Hydraulic Power Pak, power distribution center and the facilities for changing direction of the coal getting unit. The cowl of the proposed Bi-Directional Shearer drum must be reversed at each end of the face. The cowl revolves over the drum in a circular motion, requiring six to eight inches of additional height for a length of approximately six feet. Clearance is made in the rash by the development unit. Also, additional height is needed in the tail stable to permit the Shearer to go up the conveyor ramp in clearing the drum beyond the edge of the face. This is shown on Drawing C-10-35 - Underground Equipment, and in more detail on Drawings B-6-11 and 12 - Equipment Detail - Head and Tail Stables.

At the end of the panel, openings into a room connecting the extreme end of the butt entries will facilitate removing the equipment and will later act as bleeders.

The longwall equipment may be transferred to the new panel by way of the underground travelways or to an opening at the end of the butt entry and hauled to the front of the property by truck. It is a matter of economics. In the latter instance,

it will be necessary to make an opening through the backfill to the highwall.

The solid areas to the Southeast of #4 Butt entry and on either side of the old mine are too small for the economical installation of the longwall equipment but they can be recovered by the room and pillar method.

Ventilation

The two butt entries at the tail end of the longface would be on intake with a small leakage allowed into the caved area to return over the fall to the bleeders at the starting point of the face. The latter would be connected by overcast directly to the fan entry. Part of the intake volume would be circulated around the face of the development entries before joining the other portion to cross the longface. Some of this air would bleed across the falls and the remainder would go to development work on the head end of the longface. The belt entry would be intake with leakage directly into the return. See Drawing C-10-35 - Underground Equipment.

Underground Equipment - Drawing C-10-35 - Underground Equipment, Drawings B-6-11 and 12 - Equipment Detail - Head and Tail Stables

Development

The development equipment must have capacity to keep the entries advancing as rapidly as the face. This capacity must come in a uniform, continuous, limited volume, since the coal from the development must use the same butt entry belt as the longwall equipment. It is assumed the #1 Butt would be driven prior to starting the longface. This equipment must have a working range from 42 inches to 52 inches. It must have a high productivity

and be as free as possible from serious breakdowns.

A Wilcox type machine with a 40 inch cutting feed best meets the cutting and loading requirements. The discharge would be onto a conveyor designed for quick and easy advance by way of a piggyback conveyor. Transportation from the discharge point of this conveyor would be continuous by 12 inch flight conveyors to the butt entry belt near the head end stable. The final conveyor would be advanced intact by a remote-controlled hoist and must be designed to permit this.

The above equipment, under the described conditions, should average conservatively 170 tons per shift, including moving. This means an advance speed of 17 feet per shift for the development entries.

Longwall - Roof Supports

The powered roof supports are required to have a waste edge support of 40 tons per lineal foot as a minimum and, preferably, should have a margin of capacity beyond that, should greater strength be required for the second location. The supports are to be the six leg type for stability and with large canopies to give the maximum roof bearing support area to keep the rash from crumbling.

The support controls are to be designed for rapid advance by servo-lowering, again as a precautionary measure for the friable rash.

The supports and the conveyor rams are to be advanced automatically in groups by sequence from control points along the face. This type of control permits the coal to be loaded

and the conveyor and supports to be advanced with two men.

Jeffrey and Joy can meet these specifications for the seam range required. Therefore, since the objective of this project is to demonstrate, each company has been asked for a proposal to cover supports for one-half of the face.

Longwall - Coal Getting Unit

The reasons for selecting a Bi-Directional Shearer for this condition have been outlined earlier. These units are manufactured by Eickhoff in Germany, Anderson, Boyes & Co., Ltd., and British Jeffrey-Diamond Limited in Great Britain. The BJ-D 150 horsepower machine, sold by The Jeffrey Manufacturing Company, is most suitable for the purpose and conditions at this time.

Anderson, Boyes & Co., Ltd., has a 200 horsepower unit which up until recently had not been proven and is not recommended by the manufacturers for Bi-Di work at this time. The Eickhoff machine with a 170 horsepower drive has not been proven for Bi-Di work. A BJ-D 150 horsepower Bi-Di has been observed in operation in Wales and others are in use. The 125 horsepower Shearer at Sunnyside was equipped for Bi-Di work but had to be reconverted for single direction use, due to the center of the seam sluffing out behind the cowl and before the conveyor could be advanced.

Bi-Di Shearers have been observed in operation where this did not occur, but as a precautionary measure ramp plates would be used on the front of the face conveyor to gather up any coal spillage between the passing of the cowl and the advancing of the conveyor. The elapsed time between these two operations

is only minutes. For this reason, most of the sixty-five Bi-Di machines in operation in Great Britain have been installed to take advantage of the small period of roof exposure to keep a face with an extremely weak roof from being abandoned.

The Shearer would be equipped with a limited ranging drum, which is automatically activated by a Thulium Isotope sensing device to maintain a uniform horizon one inch off the floor. A Magnamatic control limits the speed of travel of the Shearer to the motor capacity. Therefore, the operator has little to do but be on hand to anticipate hard cutting or an abnormal roll, either of which would require reverting, respectively, to hand control of the machine travel or the drum range. For this reason, the operator also pushes the group button to snake the face conveyor to the face behind the machine.

Travel speed of the Bi-Di is expected to be 16 feet per minute average, which has been obtained under similar conditions and equipment. At this speed, it would require 38 minutes to cross the face.

When the Bi-Di Shearer reaches the stable (Drawings B-6-11 and 12 - Equipment Detail - Head and Tail Stables), the cowl must be reversed by being rotated over the drum, requiring from five to eight minutes. The conveyor drive and the Shearer must be advanced for the next cut, requiring up to two minutes. The picks must be checked and changes made where necessary, which, in this exceptionally soft coal, will be a minimum. The whole stable operation requires from twelve to twenty minutes.

A Bretby Automatic Cable Handler for the Shearer is a necessity. It will protect the cable and water hose, permit

the use of a separate control cable and eliminate a very tiring job.

Longwall - Face Conveyor - Drawing C-10-35 - Underground Equipment, and Drawings B-6-11 and 12 - Equipment Detail - Head and Tail Stables

The Panzer, or Armored Flight, Conveyor, segmented for vertical and horizontal movement, is one of the most important pieces of equipment in the powered roof support technique of mining. For this installation, a 30 inch conveyor with triple strand chain, traveling at approximately 200 feet per minute, is required. The carrying capacity with spill plates is greater than needed, but it has been proven that the Shearer cutting speed is materially improved where there is a free fall at the coal discharge point of the Shearer. The four drives, two at either end, should be parallel to the conveyor to permit continuation of powered roof supports the entire distance across the face from rib to rib.

Intermediate coal discharge rather than end discharge is preferable in order to keep the stable width to a minimum, allow timbering along the rib, eliminate carryback and provide an area for the haulage anchor on top of the conveyor beyond the plough-off point. It is accomplished by raising the return chain by guides to make space for the stage loader at the rear of the drive (Drawing B-6-11 - Equipment Detail - Head Stable), then mounting a plough above the stage loader. Coal passing under the plough drops through an opening in the conveyor pan beyond the plough and returns to the stage loader with the return strand of the face conveyor.

In addition to carrying the coal, the face conveyor acts as a track for the Shearer and carries the power and

communication cables, high pressure water hose and cable handler. These are built into a combination spill plate, rack and tray which also contains connecting points for the powered roof support advancing mechanism and conveyor advancing rams.

Ramp plates attached to the conveyor to scoop up loose coal as the conveyor is advanced are an important adjunct to the operation. They are insurance that coal spalling from the face before the conveyor is advanced will not cause a bow in the conveyor line and result in a crooked face. In addition, picking up loose coal will improve the floor for the support base.

To assist in advancing the conveyor drive and Shearer, a hydraulic head mover at each end is advisable, and to avoid congestion in the stable area, a chain anchored single ram type is recommended.

The face conveyor tends to creep, and to save problems at the stage loader and at each connecting point along the conveyor, the conveyor should be anchored at the ends. A Beien type (Drawings B-6-11 & 12 - Equipment Detail - Head and Tail Stables) is simple and reduces congestion in the stable. It consists of two hydraulic posts in a frame fastened to the end of the face conveyor.

Armored Flight Conveyors are available from five manufacturers, each differing in design details but quite similar in general. In this instance it is felt desirable to have the same company furnish the Shearer, the face conveyor and conveyor auxiliary equipment because all must work together. Further, Jeffrey is probably the only American company which would be manufacturing at least part of this equipment in this

country at present.

Longwall - Stage Loader - Drawing C-10-35 - Underground Equipment

The objective of the stage loader is an intermediate, uninterrupted means for transporting coal from the advancing face to the stationary transportation. In this instance, the stage loader would receive the coal at a maximum rate of up to 450 tons per hour from a plough-off arrangement inby the drive of the face conveyor and transport it to a cross conveyor which would load onto the butt entry belt.

The Jeffrey Manufacturing Company has recommended a 20 inch double strand chain 150 foot conveyor with a tripping device for this job. As the stage loader is pulled forward with each advance of the face conveyor, the tripper would remain located at the cross belt.

Using this type of conveyor, which is substantially less expensive than two Armored Flight Conveyors, one sliding over the top of the other, it will be necessary to install a conveyor anchor at the discharge end of the face conveyor, as there is no flexibility in the proposed conveyor.

Underground Coal Transportation Beyond the Stage Loader - Drawing C-10-35 - Underground Equipment

The cross conveyor must be moved with each 100 foot advance of the face conveyor. Therefore, it must be readily dismantled, moved and reset. A low type belt with rope framed intermediate structure and a mounted drive head is proposed.

The Butt entry belts must carry up to 450 tons per hour. With 30 inch units, this capacity would require an

operating speed of 550 feet per minute. The belt must be advanced or retreated rapidly. A rope structure conveyor gives best results for this latter requirement. The vulnerability of the rope belt for the main transportation is the exposed rollers which could be knocked out of line by posts or large pieces of slate traveling on the conveyor. However, with 89% of the product coming from longwall work, the exposure to this condition is at a minimum and, therefore, it is safe to use that type of equipment.

Two 2,400 foot belts are needed. The grade is about two per cent with the load and, therefore, 75 horsepower drives are specified.

Underground Supply and Mantrip Transportation

Conditions are favorable for the use of battery powered equipment for supplies and men. A tractor and supply cars would handle the supply work and transport the men. Two personnel cars are needed, one for transporting face equipment and materials on the two development unit shifts and the other for personnel. Since the development unit would be operating on two shifts, both cars would be available for supervisors or maintenance men on the third shift. The same tractor and trailers would be used for transporting the longwall and development equipment and, therefore, should be sturdily built.

Underground Communications

Two types of signaling systems are necessary on the face so that if one fails there will not be a face interruption. The MSA combination loudspeaker and telephone has Bureau approval

and has proven very satisfactory for longwall mining. The units are spaced at about 50 foot centers, with one at each end and one on the Shearer.

The second system does not need to be so elaborate. Push buttons for lights, or a buzzer, would require much maintenance. A fairly foolproof plan is a rope-operated signal switch, and at this time it appears to be the best solution to the problem.

Underground Power - Drawing C-10-35 - Underground Equipment - and Drawing C-10-39 - Surface Layout

Power would be brought to the preparation plant and the mine mouth by a 3,800 foot power line extension. The power potential available is 4,160 volts. This would be transformed at the preparation plant to 440 volts with a 300 KVA transformer, and at the pitmouth by a 30 KVA transformer to 440 and 220 volts for the fan and shop. The 4,160 volt power would be taken by underground cable to a point near the working face and then transformed to 550 volts.

The underground power system would be designed for maximum safety in accordance with the U. S. Bureau of Mines, the Pennsylvania Mining Law, and conform where practical to the British Coal Board requirements. The outdoor substation would include in order, a protective fence, lightning arrestors, fused disconnects, ground resistor, mine feeder circuit breaker with disconnects on both the incoming and outgoing sides, and a ground bed.

The high voltage underground cable would have #2 conductors, each equipped with metallic shields. The cable would

be in 1,000 foot lengths, connected with approved couplers. It would be suspended by hooks in the belt entry (intake).

An air-cooled, skid-mounted 600 KVA transformer, 4,160 to 550 volts and having dimensions permitting moving in 38 inches of height, would be located 500 feet outby the head stable. It would have positive disconnect means on the high voltage side.

Three circuits would lead out from the transformer to distribution centers: one 700 foot 4/0 550 volt cable to the head stable for the face conveyor and Shearer, one 700 foot 4/0 cable to the head stable for miscellaneous equipment and one 1,000 foot 4/0 cable to the right hand development area.

All distribution centers would be explosion-proof and mounted on skids, and have an overall height not to exceed 36 inches. They would have utilization plugs for each drive at the location and a small transformer for a 220 or 115 volt hand tool connection.

One head distribution center (furnished by manufacturer) would serve:

1 - 150 HP Shearer	
4 - 60 HP Face Conveyors	390 HP

The second head distribution center would serve:

2 - 2-10 HP Power Paks	
1 - 60 HP Stage Loader	
1 - 20 HP Cross Conveyor	
1 - 30 HP Development Conveyor	
1 - 10 HP Hoist	160 HP

The development distribution center would serve:

1 - 30 HP Cross Conveyor	
1 - 40 HP Entry Conveyor	
1 - 150 HP Miner	
1 - 10 HP Bridge Conveyor	
1 - 10 HP Hoist	240 HP
Total Underground Connected Load . .	790 HP

The trailing cable and control cable for the Shearer would be carried on a tray (mounted on the face conveyor and described earlier) to the center of the face. From that point they would be continued by means of an automatic cable handler to the Shearer.

Underground Cooling and Spray Water

A source of clean, acid-free water is necessary for cooling and dust suppression at the coal getting units. The volume required would not exceed ten gallons per minute. However, 100 gallons per minute must be available for fire protection along the belt system.

Comparative costs were prepared for extending the town water line 2,800 feet versus drilling for water and installing a submersible pump which would discharge into an underground reservoir. The latter plan proves to be less expensive.

A pump located at the underground reservoir could maintain a pressure of 140 foot head at 100 gallons per minute at the furthermost point of a four-inch line in any of the Butt entries and be within the pressure limitations of plastic pipe strung along the butt entry conveyor. A second pump would be installed at the end of the butt entry belt conveyor to provide five gallons per minute to the Shearer and five gallons per minute to the development machine at 400 p.s.i. This pressure would be reduced at the point of use to approximately 115 p.s.i. for cooling and then reuse for spray water.

Valves and connected water hose would be spaced along the entry belts for immediate fire fighting use. After the initial setup, all water lines and fire fighting facilities are

considered as cost items.

Surface - Drawing C-10-39 - Surface Layout

Pitmouth Area

The highwall type of mining calls for temporary type structures, and preferably of a movable design. The office could be a trailer, and the shop, supply house and charging station would be three movable units combined for accessibility. The fan installation also would be of as temporary a nature as possible. The fan itself would have a capacity of 30,000 cubic feet with one inch of watergauge.

Drainage along the highwall would be dammed to catch water from the small stream at #2 Butt and East of that point. From the dam it would flow out of the cut at the present entrance. A large drain pipe is already installed, so this will not be an expensive item. From the small stream West, the drainage would be guided away from openings and a drainway would be made at the original entrance at the West end of the pit.

The present road into the strip pit area would be moved slightly to the East of the present entrance to avoid the belt conveyor from the mine opening to the storage bin. Also, the road into the pit from the West end would be improved to bring supplies into the area between #1 and #2 Butt entries.

For the mining of #2 and #3 panels, a belt conveyor would be installed in the pit and between #2 Butt and #3 Butt entry openings, a distance of approximately 825 feet. After experience with the equipment, a decision would be made either to extend the conveyor to #4 Butt or to drive #4 Butt by loading the coal onto the tail end of the longface conveyor. If the

latter plan is adopted, a road must be built into #4 Butt for men and materials. This should be relatively inexpensive.

Surface Belt Transportation

The profile (See Drawing C-10-39 - Surface Layout) shows that the conveyor from the #2 Butt location to the 800 ton silo requires very little grade work or trestling, except the immediate rise from the hillside to the top of the silo.

A truck ramp, 50 ton bin and feeder for loading onto the hillside conveyor are located near the bottom of the hill and at the point just before the conveyor starts its rise to the silo. This would permit the purchase of coal from an independent operator* during the two-year period and provide a permanent loading point for trucked coal from the area after the Demonstration Mine had completed its program.

Preparation - Storage and Loading

A Flowsheet, shown on Drawing C-10-25 - General Flow Diagram, was prepared for the storage and cleaning of the raw coal and the storage and loading of the cleaned coal. The cleaning portion of the flowsheet was based on determinations

* The lessee of the railroad siding is willing to give up his lease rights so that the Demonstration Mine may use the siding, but with the understanding that the operator of the Demonstration Mine will buy a reasonable daily tonnage of his strip coal during the period.

from the washability study and from cleaning plant records of "C'" coal in the Windber locality, as described earlier in detail. The capacities and storage before and after cleaning are based on the proposed plan of operation, expected production and loading of half-trainload shipments (3,500 tons) in a shift. The latter is necessary to take advantage of very substantial freight rate reductions.

The on-the-ground study indicated the topography would lend itself well to the facilities outlined in the flowsheet, and this was verified by an actual topographic survey.

The Surface Layout, as shown on Drawing C-10-39 - Surface Layout, and Flowsheet C-10-25 - General Flow Diagram, was given to two of our area preparation plant engineering, manufacturing and construction companies for turnkey prices. The Irvin-McKelvy Company was the low bidder on the following facilities:

1. Raw coal system - beyond the underground belt discharge, including transportation by means of a 30 inch belt; truck unloading facilities comprising a ramp, 50 ton bin and a feeder; an 800 ton storage silo with a belt feeder; and a 30 inch belt to the preparation plant.
2. Cleaning Plant to handle 210 tons per hour of raw coal, including a Bradford Breaker to break the product to 3/4" x 0 and remove heavy refuse or extraneous materials; three six-foot used R&S air tables with cyclones; an 18 inch belt conveyor to a refuse bin and a 50 ton refuse bin for loading into a truck.
3. Clean Coal Storage and Loading, including a 24 inch belt

conveyor to take the cleaned coal at a rate of approximately 200 tons per hour from the air tables to a 55 foot high 36 inch lowering well at the storage pile; a 4,000 ton self loading storage arrangement with a concrete reclaim tunnel and earthen dike; and a 36 inch belt conveyor from the tunnel loading chutes to a double chute loading arrangement at the railroad loading point, designed for 600 tons per hour loading.

The turnkey bid is $348,600. This anticipates that the three air tables would be rebuilt units, but all other materials and equipment would be new. The contractor advises that if the belt conveyors, other than the 18 inch unit, are also used equipment, the price would be reduced by $62,000 to $286,600. It is realized that a contractor has no way of knowing in advance the availability of used belt equipment and, therefore, must play safe. A greater reduction could probably be made by a quotation at the time the project would be finalized.

Railroad Siding

Load and empty car storage for 3,700 tons of coal is required for half-trainload shipments. It will be necessary to extend the siding approximately 1,060 feet to meet these requirements, and an additional 140 feet if satisfactory arrangements cannot be consummated with the owner of a narrow strip of surface between the highway and the railroad siding at the end of the present siding.

To move the railroad cars through the loading point, two remotely controlled car spotting hoists are planned. If this

installation had a long life, then automatic car feeders would be recommended and this would have permitted the use of one less man in loading.

Refuse Disposal

The coal and land lease would include the privilege of dumping refuse in the old strip areas where it can readily be covered with loose material.

Development of #1 Butt

To take full advantage of permanent facilities, it is proposed to channel the low wall opposite the #1 Butt belt opening and convey the coal to the truck coal bin on the hillside. The Bradford Breaker could be mounted temporarily on top of the truck bin so that the coal could be crushed to a uniform size and the heavy rejects could be removed. The coal would then be transported by truck to the present ramp until storage pile facilities, the cleaning plant, etc., could be constructed. After that, the coal would follow the flow of the final product from the truck bin.

Application of Equipment and Deployment of Men

Longface

The longwall would start from a room connecting two groups of butt entries. In this instance, these would be #1 Butt and #1½ Butt (belt would be installed in #1½ Butt), since it is the intent to make the initial installation in the triangular area to the Southwest of #2 Butt (See Drawing C-10-35 - Underground Equipment). This will provide an approximate face length

of 300 feet very accessible from the surface. Both the narrow face and the accessibility will be helpful in the early training period of the men and in working out equipment bugs. The face will be extended to its full length inby the intersection or branching of the surface stream.

It is quite essential to maintain a straight line of supports for best roof control, so the starting line is most important. A line should be painted on the roof to align the face conveyor for the first cut.

The operator of the Shearer travels with the machine, even though it is automatically controlled (1) for speed within the limitations of the motor and (2) for maintaining a uniform horizon through a sensing device. He must anticipate trouble so that he can switch to hand-speed control when difficult conditions are encountered, or hydraulically raise or lower the drum when the seam changes direction too rapidly for the relatively slow action of the sensing device. Also, as he passes a station he sets in operation the group controls for advancing the conveyor at the proper distance behind the machine while he is moving to the next station.

When the machine reaches the end of the face the cowl is rotated over the drum in readiness for loading in the opposite direction. The job requires five to eight minutes. The conveyor drive end is then moved forward for the next cut, which requires one or two minutes. The bits are then checked and the Shearer is ready to leave the stable, twelve to twenty minutes having elapsed. The drum turns in the same direction at all times. This means cutting up on the seam when moving one way and down on the seam

when moving in the opposite direction. The reverse actions tend to compensate for any tendency to crawl.

The group roof support controls proposed for this installation require only one man to advance the supports. He follows the conveyor as it is snaked forward against the face, opens the control for a group of supports ahead and, as they move in sequence to their new position, travels along behind the advancing supports to the next control point.

Two mechanics look after the equipment. One concentrates his efforts on the hydraulic problems of the supports, and the other man with electrical and mechanical work on the other equipment. The roof support system is designed to permit maintenance work and replacement throughout the operating shift. The Shearer is a relatively simple machine, and it too is designed so that built-up replacement units can be installed, rather than repair work at the face.

These maintenance characteristics make it practical to operate the longwall three shifts, and continuous operation is most desirable for best roof control.

It is the intent that the Shearer should not be stopped for the lunch period, and so few men are involved in the actual face operation that a change-out is not a serious problem. It is also the plan to have the oncoming shift replace their counterparts at the face in a manner by which no part of the operation is stopped. This procedure will make one and one-half hours available for maintenance work which might require down time.

One man at the head stable starts and stops the conveyors as required, cleans up shearer spillage at the face end,

assists the operator when the Shearer is in the stable, advances the drive, stage loader, the 100 ton chocks and the hydraulic posts and link bar and does other chores. A man at the tail stable has the same duties, with the exception of operating the conveyors.

Each operating crew would consist of:

1	Foreman
1	Mechanic
1	Electrician
1	Shearer Operator
1	Support Advancer
1	Head Stable Man
1	Tail Stable Man
7	Total

In addition, three men would be required on a special shift, which would include the one and one-half hours of down time. These men would advance the cross conveyor at each 100 feet of advance and do such maintenance or preventative maintenance as would be required.

Development

The first longwall panel in a series of advancing panels, with the butt entry system, requires the development of two groups of butt entries. After that, only one set needs to be driven with each advancing panel. Therefore, it is necessary either to have the one set driven prior to starting the first panel or have facilities to drive both at the same time. In this instance, it appears advisable to limit equipment to one set and drive #1 Butt during the six to eight months required for delivery of the longwall equipment.

After completing the development of #4 Butt, the equipment could be used for mining the solid coal in the area between

#4 Butt and the outcrop. The latter is too small for practical extraction by the longwall system. The development coal will use the same belt for transportation to the surface as the longwall.

The distance any entry can be driven ahead continuously is limited by ventilation. However, in any series of advancement, i.e., in moving from one entry to the next, each succeeding entry may be driven an additional breakthru in length. To permit taking full advantage of this and at the same time not delay the advance of the longface at any time, a 200 foot conveyor acts as a balancing unit between the discharge point of the cross conveyor, which is the entrance to the development area, and the end of the belt.

Each development crew is a complete operating unit in loading, moving and preventative maintenance and consists of:

1 Foreman
1 Loader Operator
2 Face Men
1 Supply Man

The supply man would use a battery-operated personnel car to carry pans, chain and supplies to the face, and from face to face. This greatly increases his ability to accomplish work.

It is impractical to operate this equipment through the lunch hour, but it is planned to have the oncoming shift take over equipment controls and jobs without any stoppage of work at the end of the shift.

Service

The main service work, under the direction of an assistant mine foreman, would be done on an overlapping shift

and would include the one and one-half hours accumulated by the production crews changing out at the face. In this way, no special or disrupting arrangements need be made for manpower for periodic belt advancement and there will be least interference with production. Also, it is the only time of the day when supplies can be delivered to the longface without interfering with production.

A limited amount of service work will be done on the other two shifts under the supervision of the mine foreman on one shift and an assistant mine foreman on the other, so that men will be available for emergency work or to fill in on the production crews in case of absenteeism.

The cleaning plant will operate three shifts, and one man will handle the job each shift. Refuse will be hauled from the plant on two shifts and, since it is a trucking matter, it would be handled best by contract. But for the purpose of comparison, two refuse men will be shown as part of the organization.

The gravity loading storage pile permits the loading of the 3,500 ton train in one shift. This is being handled by two men where a railroad car feeder is used but, since the feeder is not an economical investment for a two-year period, car spotting hoists and a crew of three men will be used. Loading will not be a full time operation. These men are, therefore, available for other outside work, including supplies, timbering openings for the next panel and other dead work.

A full office force of four people to handle all payroll records, supplies and shipping is considered here so that the comparison of manpower will be complete. All office work,

except that generally considered as administrative, is included.

The type of mining would not require a full time engineering crew, so it is assumed practical to contract that work, but include one man in setting up the organization.

The organization summary follows:

	Initial Development* 6 Mos.	Training Period** 2 Mos.	Two Years After Training Period Shift 1st	2nd	3rd	Total
Production (3 Shifts)						
Longwall	-	24	7	7	10	24
Development	15	10	5	5	-	10
Total	15	34				34
Service						
Underground						
Mine Foreman	1	3	1	1	1	3
Supply	-	2	-	-	2	2
Ventilation & Drainage	-	-	1	1	-	2
Belt	1	1	1	-	-	1
General	2	3	-	-	4	4
Mechanic(Preventative)	-	2	1	1	1	3
Outside						
Superintendent	-	1	1	-	-	1
Chief Electrician	1	1	1	-	-	1
Engineer (Contract)	1	1	1	-	-	1
Office-Supplies-Shipping	1	3	3	1	-	4
Cleaning Plant & Refuse	1	2	2	2	1	5
Loading	-#	1##	3	-	-	3
Shop & Charging	1	2	1	2	1	4
Total	9	22				34
Grand Total Men on Payroll	24	56				68

* It is assumed that the cleaning plant and 4,000 T.storage with rapid loading facilities will be available after two months.

** Includes the installation of the longwall equipment.

\# Seven days will be required to accumulate coal for half-train loading; therefore, it is practical to use 3 men normally having other duties.

Loading every $3\frac{1}{2}$ days, one man is shown. It is the intent that he will help with other work on non loading days and that two men from the organization will help him on loading days.

It is realized there will be idle day work and overtime. This will be treated as a lump sum in calculating costs.

Production - Longwall

It was developed earlier that the Bi-Di Shearer would cut across the face in 38 minutes and that 12 to 20 minutes would be required each time the Shearer reached the end of the face. Assuming 18 minutes for the latter time, then a one-way cycle would be completed in 56 minutes, theoretically, and with 70% operating efficiency (Sunnyside had 83% for four months), the actual time would be 80 minutes.

It is planned that the shift change would take place at the face, with the oncoming men taking over and continuing without loss of production. Allowing for an average travel time of 30 minutes and assuming the equipment will be worked throughout the lunch period, 7½ hours, or 450 minutes, would be available for work.

On the above basis, 450 divided by 80 minutes, or 5.6 cuts of 27 inches depth would be made each shift. The cut heights would be 44 inches and 41 inches with an expected average of 43 inches. The per shift average production, therefore, would be 1,080 tons and the face advance 27" x 5.6 cuts, or 12.6 feet per shift. Allowing for cleaning loss, the expected cleaned product would be 1,015 tons per shift.

It is not reasonable to expect normal efficiency from a group of men who have not worked together and are unfamiliar with the equipment. Therefore, it is safe to assume their production for the first two years would be 85% of that expected

from a seasoned organization. This reduces the expected clean coal per shift to 860 tons and 10.7 feet face advance per shift.

Production - Development

As determined earlier, a production of 170 tons, with an average butt entry advance of 17 feet, would be expected from each shift, with a total of 340 tons of raw coal, or 320 tons of clean coal per day of two shifts. The development crews would be working together for six months before the longface is started and the equipment is familiar; therefore, the 85% correction is not applicable.

The development unit would operate three shifts per day for six months and two shifts per day during the longface training period. This is required in order to complete, at 17 feet advance per shift, the development necessary for starting the longwall face.

Production - Summary

Let us assume that the longface equipment would be installed and the training period would be completed on the narrow face on #1 Panel during the first two months of operation, after which the longface, operating three shifts, the daily advance would be 32.1 feet.The #2 Butt entries would need to be operated two shifts for this rate of advance.

The total clean coal output for the first six months would be 480 tons per day or 58,000 tons and, during the training period, 36,000 tons or an average of 900 tons per day, including installation of the longwall equipment.

For the next two years, approximately, let us assume the longface operates three shifts each day, producing 2,580 tons of clean coal and advancing 32.1 feet, and one development unit operates two shifts, producing 320 tons and advancing 34 feet per day.

The total clean coal output during the normal production period of 374 days would be 2,900 tons per day.

The total operating life of the first installation, based on 20 days per month for the development and training periods and 220 days per year with normal production, would be 28 months.

Period	Days	Tons Per Day			Total Tons
		Development	Longwall	Total	
Development	120	480	-	480(20.0)*	58,000
Training	40	320	580	900(16.+)*	36,000
First Year	220	320	2,580	2,900	638,000
Second Year	154	320	2,580	2,900(42.7)*	447,000
Grand Total	534				1,179,000

* Figures in ( ) are tons per man on payroll.

In addition to the above days of operation, two periods of ten days each should be set up for moving the face equipment and overhauling the Shearer. The schedule of 220 working days per year will permit these two periods within the 20 months' time determined as the life of the normal longwall mining.

Cleaning Plant Capacity

The cleaning plant has a normal capacity of 210 tons per hour of raw coal for 22 hours per day, allowing two hours for maintenance. This totals 4,620 tons raw coal and 4,340 tons

clean coal. An efficiency of 85% is fair for an air plant fed from a large storage bin and having a free discharge into a storage pile. On this basis, the plant has a capacity of 3,690 tons per day.

It is agreed to buy a reasonable daily tonnage from the stripper now mining the upper seams on the same property. Should this average 300 tons of clean coal per day, the plant would still have adequate leeway for peak performances.

Estimated Costs Per Ton

	Develop-ment	Training* Period	Normal Production
Months Operated	6	2	20
Days Operated	120	40	374
Tons Per Day	480	900	2,900
Tons Per Man On Payroll	20	16+	42.7
Labor & Associated Expenses			
Straight Time @ $30/shift	$1.500	$1.870	$ .702
Overtime	.025	.030	.050
Vacation Pay Reserve	.048	.060	.022
Work.Comp-FICA-Unemp.Comp.	.197	.246	.097
UMWofA Welfare & Ret.Fund	.400	.400	.400
Total	$2.170	$2.606	$1.271
Supplies			
Face Incl. Bits	.280	.225	.136
Other Underground	.050	.050	.035
Outside	.040	.040	.023
Battery-Cap Lamps Rental**	.027	.014	.005
Trucking (Refuse)	.025	.027	.017
Mine Office	.060	.055	.020
General	.050	.050	.017
Repairs and Oil			
Longwall Equipment#	-	.035	.047
Development Equipment	.055	.020	.006
Conveyors	.018	.013	.013
Other Underground	.034	.023	.008
Surface Plant	.040	.040	.035
Oil and Grease	.040	.038	.035
Power	.180	.200	.090
Total	.899	.830	.487
Total Operating Cost	$3.069	$3.436	$1.758

* Including installation of longwall equipment
** Tractor batteries (2) 90% rental - 48 mos.,or $121/mo. -

** Cont. - 75 Cap Lamps on straight rental @ $1.78, or $134/mo.
# Based on Shearer @ $.025 per ton and Supports @ 3% per year.

	Develop-ment	Training* Period	Normal Production
Overhead			
Deferred Operating Expense			
Roof Supports (1)	-	.047	.095
Shearer (2)	-	.085	.085
Development Loader (3)	.015	.015	.015
Conveyor Pans & Chain (4)	.032	.032	.032
Belt Conveyors (5)	.015	.015	.015
Major Equipment Moves (Three)	-	.020	.020
Coal Royalty	.200	.200	.200
Equipment Rental (6)	.366	.557	.697
Contingencies (Capital)	-	-	.050
Insurance	.023	.042	.014
Taxes - Improvements	.012	.006	.002
Surface Rental	-	.001	.001
Depreciation & Depletion	(.034)	(.695)	.255
Administration	.150	.150	.150
Sales	.150	.150	.150
Engineering	.041	.041	.041
Total	.970	.666	1.822
Total Estimated Costs	$4.039	$4.102	$3.580

* - Including installation of longwall equipment

(1) 10.8% of first cost per year - Overhaul after fourth year

(2) $.095 per ton - Overhaul each 700,000 feet of mining

(3) Overhaul every two years @ $15,000

(4) Replace chain and pans after two years

(5) Replace belts after six years

(6) Equipment lease would be divided into three parts- the Surface Equipment with a 26 month lease, the Development Equipment with a 52 month lease and the Longwall Equipment with a 46 month lease. Rental payments would include only straight interest at 10% until normal operation was underway. After that rentals would include reduction of principal and interest averaged over the life of the lease.

The surface plant would not be completed until two months after starting development, so that lease will not be effective until that time. However, part of the equipment will be in use

so assume for each of these two months that rental includes one-half of the monthly interest. From then until normal production the rental would be straight interest.

It is most probable that after the Demonstration Mine is finished at the Windber location the surface plant would continue to be used by local small operators who do not have sufficient capital to invest in cleaning and storage for half-trainload shipment. Without these two very necessary facilities, these operators are now very seriously handicapped and may have been forced out of business. However, for our purpose it is assumed that the surface plant must be amortized during the 20 month period.

Lease Projections	Equipment Cost	Period	Reduction Principal	Monthly Rentals
Surface Equipment	$ 115,775	26 Mos.	20 Mos.	$ 6,600
Development Equipment	327,670	52 "	44 "	9,164
Longwall Equipment	763,410	46 "	44 "	21,346
	$1,206,855			$37,110

It may prove advisable from a tax standpoint to increase equipment rental payments by shortening the life of the equipment leases. This will depend upon conditions and circumstances surrounding the second location for the longwall equipment. A provision for such an option should be embodied in the lease to avoid later problems.

Purchased Coal Cost Discussion

The purchased strip coal should absorb its pro rata share of costs involved with cleaning and storing and overhead, as well as allow a small profit. Therefore, in arriving at a

fair price for this product, the following cost items should be deducted from the realization:

Outside Supplies	$.023
Refuse	.034
Cleaning Plant	.030
Loading	.028
Mine Office	.010
Surface Plant Repairs	.035
Power	.020
Surface Equipment Rental	.075
Surface Equip. Depreciation	.019
Administration	.075
Sales	.150
Profit	.250
	$.749

Assuming the coal sales price to be $4.10, then a fair price for the purchased strip coal on a clean coal basis would be $4.10 - .75, or $3.35.

The purchase and sale of this strip coal would reduce total costs as follows:

	Without Strip Coal	With Strip Coal
Development Period	$4.039	$3.78
Training Period	4.102	3.91
Normal Period	3.580	3.56

The strip coal should be handled as a separate operation to avoid distortion of the results from the demonstration project.

Investment - Specifications

Initial Development Period	Deposit	Cash	Lease
General			
10 Core Drill Holes	$ -	$ 2,000	-
Grading-Drainage-Roads	-	3,000	-
Legal-Permits-Bonds	1,000	500	-
Compensation Insurance	*	-	-
Coal Lease Deposit	10,000	-	-
Power Line to Plant (3,800')	-	5,000	-
Siding Extension Sub grade	9,900	-	-
Siding Extension Track	15,000	-	-
Total	$ 35,900	$ 10,500	-
Surface			
Temporary - #1 Butt Development			
650' Belt Conveyor (Used)-#1 Butt to Truck Bin**		$ 9,000	$ 9,000
Cut through Lowwall opposite #1 Butt		900	-
Temporary mounting of Bradford Breaker		1,500	-
Temporary appendage on truck bin for refuse		1,000	-
Total		$ 12,400	$ 9,000
Raw Coal Transportation+			
1425' 30" Raw Coal Conveyor (Used)-Trestle		$ 22,750	$ 38,500
2 Merrick Weightometers - Totalizer - Test Chain		-	7,735
50 ton Truck Bin - Ramp 800 ton Silo - Roof - Feeder 180' 30" Feed Conveyor (Used) to Plant - Trestle		23,800	7,400
Total		$ 46,550	$ 53,635
Cleaning Plant+			
8'x14' Bradford Breaker 3 (Used) R&S 6' Air Tables Complete 130' - 18" Refuse Belt Conveyor-Trestle 50 ton Refuse Bin		$ - 107,200 -	$ 8,000 - 6,000
Total		$107,200	$ 14,000

* Operating company would include this new mine with present policy.

** Drive-Tail Piece-Cover Only. (For later use #2 Butt to #3 Butt)

\+ Turnkey basis.

Clean Coal Storage and Loading[+]	Cash	Lease
300' - 24" Clean Coal Storage (Used)Trestle 4000 ton Gravity Loading Storage 55' - 36" Lowering Well Earthen Dike	$ -	$ 6,600
180'- 6x8' Reclaim Tunnel-Gates-Chutes	50,700	-
375' - 36" Reclaim Conveyor (Used)-Trestle Double Track Loading Arrangement	-	12,000
2 Remote Controlled Hoists (Used)	500	2,000
Total	$ 51,200	$ 20,600

Miscellaneous		
3 - 100 KVA Transformers 4160/440 (Used) Complete with cutouts and lightning protect.	$ -	$ 1,120
3 - 10 KVA Transformers 4160/220 (New) Complete with cutouts and lightning protect.	-	520
Office & First Aid Room (Used Trailer)	-	2,000
Office Equipment (Used)	-	900
Shop-Supply House-Charging Sta.-Lamp House	6,000	-
Shop Equipment - Bins	4,000	-
30,000 cu.ft. @ 1" wg. Fan (Used)	1,000	1,000
Fire Extinguishers & First Aid Equipment	600	-
Michigan 17A HiLift (Used)		15,000
Total	$ 11,600	$ 20,540

+ Turnkey basis.

Underground

Miscellaneous		
9 - Highwall Openings	$ 2,700	$ -
Bore hole, Submersible Pump, Dam	1,500	-
Booster Pump-200'-4" Pipe - 160#	460	850
150' Fire Hose-Nozzle-Valves**	500	-
Face and Special Tools	-	1,200
Rock Duster (Used)	-	700
Telephone System	-	800
Total	$ 5,160	$ 3,550

** Additional pipe, fire hose, nozzles and valves to be cost items.

Underground Cont.	Cash	Lease
Power		
Surface Substation - 4160 V.-Non closing Breaker - Arrestors - Disconnects - Grounding Resistor and Check System with enclosure for mine entry as required by Commonwealth of Pennsylvania	-	$ 7,000
Fence and Miscellaneous	800	-
5 - 1000' lengths #2 - 3/C, SHD Cables-5000 V.	-	15,585
10 - Cable mounting Sockets and Receptacles	-	2,500
600 KVA Air Cooled Transformer - 4160-550 V., including skid mounting - incoming gear plug - cutouts - 3 transformer core and coils - Lightning arrestors - secondary grounding resistor - 3 secondary circuits each 800 amp. breaker - ground trip protection - 3 output receptacle and plug interlock system	-	$ 12,700
3200' - 4/0 - 3/C-G Cable - 600 V.	-	14,290
Underground Distribution Centers - 550 V.		
A. Development - 5 circuit, skid mounted, Each circuit 5 - 7 amp. unbalanced phase ground trip - output receptacle and plugs- Total connected loads 240 HP -	-	2,815
B. Head Stable - 5 circuit same as A - with Total connected loads of 160 HP -	-	2,625
Total	$ 800	$ 57,515

Transportation		
Coal		
2 - 2400' - 30" rope frame Belt Conveyors - 75 HP Drives Complete with Controls	-	$143,850
Men and Supplies		
Kersey 944 - Open type Tractor	-	$ 5,775
Winch for Tractor	-	1,400
4 - 2½ ton Trailers	-	1,740
2 - Personnel Cars - Batteries and Charger	-	5,405
Charger for Tractor	-	1,475
2 sets Tractor Batteries (90% rental)	-	650
Delivery of Above	-	$ 150
Total	-	$ 16,595

	Deposit	Cash	Lease
Development Equipment			
Jeffrey 100 M Continuous Miner to cut 52"		-	$ 56,510
94-D Bridge Conveyor		-	6,855
300' 61 AMC Flight Conveyor - 30 HP		-	16,030
67' 61 AMF Flight Conveyor - 30 HP		-	6,625
200' 61 AMF Flight Conveyor - 30 HP		-	8,625
Solid Bottom for Pans @ $15/6'		-	1,400
602 Portable Winch		-	3,780
600' One inch High Pressure Hose		-	615
4 Couplers		-	25
500' 4/0 Trailing Cable 3/C-G		-	2,250
300' #2 Cable 3/C-G		-	535
800' Control Cable		-	510
Fire Extinguishers & First Aid Equipment		-	400
Total		-	$104,160
Development		$ 2,000	-
Total		$ 2,000	
Total Initial Development Period	$ 35,900	$247,410	$443,445

Longwall Operation

Armored Flight Conveyors

636' - 30" Triple Strand Chain - Chain speed 200' per minute - 4 - 60 HP Drives mounted parallel to the Conveyor - Control Panels - Low Tail End Section to allow maximum Shearer travel - Complete with Combination Spill Plates and Supports for Bretby Cable Handler, Communication and Power Cables, 1" High Pressure Water Hose and Connection Brackets for Conveyor Advancing Rams and Powered Support Attachments - Ramp Plates - Trapping Bars - Intermediate Discharge using arrangement developed by Underground Mining Machinery, Ltd., or equal - Beien type Anchors at each end of Conveyor - Single Ram Conveyor Head Movers with Chain Anchors at each end of Conveyor - Face Signal System - and Bretby Cable Handler equipment $106,900

Bi-Di Shearer and Miscellaneous

150 HP Bi-Directional Shearer with limited ranging drum controlled by a sensing device for maintaining a uniform horizon one to

two inches off floor coal - A haulage chain chain is preferable, but if space cannot be made available for the chain anchor within the stable width limitations set out in Drawings B-6-11 & 12-Equipment Detail-Head and Tail Stables, then cable can be used - Complete With Controls - Double spiral vane disc for cutting 44" x 27" and loading cowl, both of a make which has proven satisfactory $ 48,900

A second drum-41" x 27" and cowl 3,500
700' 4/0 - 3/C-G Shearer Cable 3,150
700' #8 - 2/C Control Cable 450
800' One inch - 400# Water Hose 820

Total $ 56,820

Powered Roof Supports

Six leg Supports to extend from rib to rib (639') with practical end clearance at ribs-Having waste edge yield of 40 tons per lineal foot of face With margin of capacity for later installation of approximately 48 tons per lineal foot by change of relief valves - Because of the rash problem, minimum centers are specified even though support strength would permit larger centers - Canopies to be of large area and articulated-The support advance is to be by servo-lowering at a cycle speed of about six seconds - Conveyor advance to be activated by Shearer operator by group control - Supports are to be advanced by group control and both conveyor advance rams and supports to advance in sequence from either end of face - Cats-eye reflectors on front legs for aligning supports-Working range to be 44" to 32" with a height of 52" by extensions for supports to be located in higher areas in stables, See Drawings B-6-11 and 12-Equipment Detail-Head and Tail Stables - A pressure indicator to be supplied for each relief valve circuit so that pressure at relief valves can be determined readily - The hydraulic working pressure not to exceed 1500 p.s.i. - The hydraulic system to be adequate to operate both conveyor advance and support advance simultaneously and hydraulic pump to be supplemented by a second pump which automatically goes into operation if line pressure is reduced - Complete with Controls - Hydraulic fluid to be a water-oil emulsion -

Powered Roof Supports-Cont.	Cash	Lease
Complete with all hoses - Exposed surfaces to be treated with rust-resisting coating- To be of design in total and detail meeting approval of the British National Coal Board		$535,040
Stage Loader and Cross Conveyor		
150' Jeffrey 20" Conveyor - double strand chain with tripper to load onto Cross Conveyor - Capacity 450 tons per hour - Complete with drives and controls - Tail end section designed to fit under Armored Flight Conveyor -		24,000
66' 30" - 52 HC Belt Conveyor with Crawler mounted Drive Head and rope framed structure - Capacity 450 tons per hour - Designed for rapid dismantling, moving and reassembling- Complete with Drive and Control -		15,500
Total		$ 39,500
Miscellaneous		
Portable Winch for advancing Stage Loader		$ 3,780
High Pressure Pump		1,500
Power and Control Cables for Conveyors and Winch		2,200
88 Hydraulic Props with Link Bars		11,440
2 sets of 2-100 ton Self Advancing Chocks- 52" height		1,500
MSA Paging System - Combined loudspeaker and telephone - 50' centers across face at loading station, on Shearer, at transfer point and at belt loading point - Batteries and Cable -		4,230
Fire Extinguishers and First Aid Equipment		500
Total		$ 25,150
Development		
Longwall Equipment Installation	$ 8,000	-
Training Period	17,000	-
Total	$ 25,000	-

Investment Summary

	Deposit	Cash	Lease
Initial Development Period			
General	$35,900	$ 10,500	-
Surface			
Temporary for #1 Butt	-	$ 12,400	$ 9,000
Raw Coal Transportation	-	46,550	53,635
Cleaning Plant	-	107,200	14,000
Clean Coal Storage and Loading	-	51,200	20,600
Miscellaneous	-	11,600	20,540
Total Surface	-	$228,950	$ 117,775
Underground			
Miscellaneous	-	$ 5,160	$ 3,550
Power	-	800	57,515
Transportation	-		
Coal	-	-	143,850
Men and Supplies	-	-	16,595
Development Equipment	-	-	104,160
Development	-	2,000	-
Total Underground	-	$ 7,960	$ 325,670
Total Initial Development Period	$35,900	$247,410	$ 443,445
Longwall Operation			
Armored Flight Conveyor	-	$ -	$ 106,900
Bi-Di Shearer and Miscellaneous	-	-	56,820
Powered Roof Supports	-	-	535,040
Stage Loader and Cross Conveyor	-	-	39,500
Miscellaneous	-	-	25,150
Development and Equipment Installation	-	25,000	-
Total Longwall Operation	-	$ 25,000	$ 763,410
Total	$35,900	$272,410	$1,206,855
Summary Total		$1,515,165	
Allowance for Contingency		50,000	
Engineering-Development-Feasibility Study-Detail Specifications-Construction Supervision-Consultation-Studies and Reports throughout 2-year life of the Operation - Less ARA Grant for Study, or Balance to be reimbursed at $.041 per ton until liquidated		48,000	
Grand Total		$1,613,165	

Market

The feasibility study was concerned with an operation projected to produce a coal suitable for steam generation purposes at a capacity of 2900 tons per day. This production was to be augmented by 300 tons per day of clean coal being mined from the upper seams of the same property by others. There would be available, therefore, 3200 tons per day of coal of the following approximate analysis.

Ash	8.50
Volatile Matter	15.60
Fixed Carbon	75.90
	100.00
Sulphur	1.60
Btu (Dry Basis)	14,200
Btu (Moisture and Ash Free)	15,527
Fusion Temperature of Ash	2,500°F.
Grindability	103

The foregoing information has been exposed on a serious formal basis to the following organizations:

1. Mr. Walter Lloyd, Manager
   Coal Research and Development
   The Pennsylvania Railroad Company
   1534 Transportation Center, 6 Penn Center Plaza
   Philadelphia, Pennsylvania 19104.

2. Mr. John C. Herbert, Vice President
   Potomac Electric Power Company
   Washington, D. C.

3. Mr. T. J. Trueb, Assistant Fuel Agent
   Mr. George R. Minasian, Director Community Relations
   Consolidated Edison Company of New York
   4 Irving Place
   New York City.

The nature of the project and the specifications of the proposed production have been discussed. The capability

of the property is shipment in half train loads of 3500 tons which would be acceptable to the Pennsylvania Railroad, on which line the shipment would originate. The two companies, Consolidated Edison and Potomac Electric, enjoy close relationship with the Pennsylvania Railroad. Both utility companies are acquainted with coal from the C' seam. Potomac Electric has been running tests at its Chalk Point Station on coal from this area and of the analysis disclosed. There is no unsurmountable obstacle to its use. It is using some of this coal presently.

Consolidated Edison has been a user of C' coal but has been using coal of higher volatile content of late. It is considering lowering its specification for volatile content and would give C' coal consideration if available in quantity at a satisfactory price.

At the present time there is a demand for steam coal for export and coal from the demonstration mine would meet the specifications.

It was considered at the outset of this project that the Consulting Engineers should obtain commitments for the projected output of the mine. As discussions have developed and as the project has taken shape it is the opinion of the consulting engineers that firm commitment for the output would be a usurpation of the function of the operating organization and could work to its disadvantage should a commitment for the production be taken at too low a price. Hard trading on behalf of the seller would be precluded by the flexible nature of the

project during the engineering stages and before the operator's function should come into play.

Therefore the consulting engineers have undertaken to establish a reasonable price for the product of the mine cleaned as proposed in this feasibility study.

This reasonable price has been established as in excess of $4.10 per share under present economic conditions. The figure of $4.10 per ton on cars at the mine loaded as part of a half train load shipment has been used in further discussion.

The consulting engineers have estimated the tonnage of clean coal available from this property to be 1,230,000 tons (Refer to page 15). This would be recoverable over a period of about 28 months (Refer to page 48 - Production Summary). It is the opinion of the consulting engineers, based on inquiries directed to informed sources, that the marketing of the coal at the rate projected can be accomplished by the operating company.

Conclusion

The salient observations derived from the work of this study are set out below.

The Central Pennsylvania coal reserves are adaptable largely to longwall mining techniques using powered roof supports and full caving. Equipment to operate under most mining conditions and seam thicknesses of Central Pennsylvania is now available but must be chosen and applied properly.

The C' (C prime) seam has the largest reserves of the various seams in Somerset County.

The site chosen for the Demonstration Mine in the C' seam has mining conditions adapted to the longwall system of mining.

Inquiry into market conditions discloses assurance that a 13,600 B.t.u. product at $4.10 per ton, f.o.b. mine, shipped in half-trainload shipments, is competitive with residual oil on the Eastern Seaboard. A substantial market is available to the Central Pennsylvania Field for the product at this price both in the U.S.A. and overseas.

The C' coal at this location can be mined by longwall mining technique, cleaned and loaded in half-trainload lots as a 13,600 B.t.u. (as received) product and be profitable with a realization of $4.10 per ton.

Larger operators in the Central Pennsylvania area, though hesitant to try the new technique themselves, are developing a keen interest, engendered by the activity and

discussions preparatory to the launching of the Demonstration Mine project. This interest is quickened also by the sales promotion of manufacturers who have begun to sell longwall equipment in the U.S.A. and by the decision of Bethlehem Steel Company to make an installation in Cambria County. The Bethlehem Steel installation, naturally, will not be readily available for observation until it has been perfected, and it is questionable whether Bethlehem policy would permit overall cost data to be made public for some time, if ever. The Demonstration Mine would provide the location where observations could be made readily and cost figures examined by individuals or groups with genuine interest in its performance.

Longwall mining equipment can be made available to operators on a leasing basis. A well-known industrial banking organization has examined the nature of the demonstration mine installation and has expressed interest in leasing the equipment to an acceptable operator on the basis of a feasibility study such as this paper.

Since longwall mining installations require a relatively high capital expenditure, leasing would place the necessary equipment within the reach of operators who might otherwise be deprived of the opportunity.

Longwall mining machinery and equipment can enjoy the privilege of insurance protection by responsible carriers. The rates are dependent upon the experience and character of the operating group, as well as mining conditions.

The property examined and projected in this study

will require a total capital expenditure to equip it for longwall mining exclusive of working capital but inclusive of an allowance for contingencies of $50,000, of an amount of $1,613,165 which would be divided as follows:

Deposits	$ 35,900
Cash expenditures	272,410
Total Cash required	308,310
Leased equipment	1,206,855
Allowance for contingency	50,000
Engineering	48,000
Total	$1,613,165

This property is expected to generate cash from its operation in the following manner and amounts:

Total Cash Realization* 1,230,000 tons at $4.10	$5,043,000
It should generate Net Profit Before Taxes at present prices of	639,600
It will develop from internal funds (depreciation and depletion)	313,650
Total Cash generation	$ 953,250

The total cash generation is in excess of lease payments for equipment and the advantageous acquisitions possible as a result thereof.

Projected Balance Sheets and Statements of Source and Application of funds and Profitability are omitted since the operator and terms and conditions of financing are yet undetermined.

* Exclusive of sales of any strip mine coal purchased and processed by the cleaning plant.

Recommendation

It is the opinion of the consulting engineers that the property studied is suitable for longwall mining with caving and will provide a profitable initial step for the operating group to practice the longwall art. A second property suitable for longwall practice, accessible to the first, is an essential part of the total program to provide continuous profitable operation. There are properties available known to the consulting engineers which would satisfy this condition.

The project is recommended, therefore, as being feasible.

Allison L. Bayles & Associates

14 October 1964

EXHIBIT I

OPTION

By and Between

The Berwind-White Coal Mining Company

and

Somerset County Development Council

and

Community Development Association
of Windber

O P T I O N

THIS INDENTURE, made and concluded this 12th day of June, 1964, by and between THE BERWIND-WHITE COAL MINING COMPANY, a corporation organized and existing under the laws of the Commonwealth of Pennsylvania, party of the first part,

A
N
D

SOMERSET COUNTY DEVELOPMENT COUNCIL, whose place of business is at 118 West Main Street, Somerset, Pennsylvania, and COMMUNITY DEVELOPMENT ASSOCIATION OF WINDBER, whose place of business is at 505 Fifteenth Street, Windber, Pennsylvania, both non-profit corporations organized and existing under the laws of the Commonwealth of Pennsylvania,

O
R

THEIR NOMINEE, subject to the approval of BERWIND-WHITE, parties of the second part.

WITNESSETH:

WHEREAS, the party of the first part is owner of certain coal lands situate in the Township of Paint and the Borough of Windber, County of Somerset, and Commonwealth of Pennsylvania, hereinafter referred to and more particularly set forth in a Lease Agreement hereto attached and marked Exhibit "A"; and

WHEREAS, the parties of the second part have sponsored an economic and engineering study to determine the feasibility of establishing in Central Pennsylvania a demonstration mine using a so-called longwall system of mining with powered roof supports to demonstrate that this technique can be applied successfully to produce coal from thin seams of the area at a price to be delivered to the Eastern Seaboard in competition with residual oil. If said study proves the above to the satisfaction of all concerned, then the parties of the second part will enter into a Lease Agreement with the party of the first part under terms as outlined in the aforesaid Exhibit "A".

NOW, THEREFORE, in consideration of the payment of One Dollar ($1.00) by the parties of the second part to the party of the first part, the receipt of which is hereby acknowledged, the said party of the first part does hereby grant to the parties of the second part, the right to go upon said premises at any time during the term of this Option, through

their agents, laborers, and assigns, and with whatever equipment is required for the purpose of prospecting said coal, to test said land for coal, and to take therefrom sufficient coal for the purpose of making analyses and tests.

This Option shall begin with the date hereof and shall expire at 11:50 p.m., on October 31, 1964, during which time the parties of the second part shall have the exclusive right to lease the premises for the purpose of extracting the coal therefrom in accordance with the terms and conditions set forth in said Exhibit "A". The parties of the second part shall exercise their right to lease by executing two copies of the aforesaid Exhibit "A" and forwarding said copies to the party of the first part, which shall thereupon be legally bound by the terms of this Option to execute the said Lease and to enter into all the undertakings contained therein.

Insofar as the party of the first part has the right so to grant such rights, the parties of the second part shall have the free and uninterrupted use of all roads and rights-of-way over said premises for the purpose of testing and prospecting for coal during the term of this Option, but shall use their best efforts not to damage the premises beyond that which is necessary for conducting the exploration and tests, and with the understanding by the parties hereto that the parties of the second part assume all responsibility for claims for damage to property and injury to persons.

IN WITNESS WHEREOF, and INTENDING TO BE LEGALLY BOUND, the parties have hereunto set their hands and seals the day and year first above written.

ATTEST: THE BERWIND-WHITE COAL MINING COMPANY

o/s J. M. Baxter
Secretary

By o/s R. H. Seese
Vice President

ATTEST: SOMERSET COUNTY DEVELOPMENT COUNCIL

o/s E. L. Pritt
Secretary

By o/s Wm. G. Baltzer
President

ATTEST: COMMUNITY DEVELOPMENT ASSOCIATION OF WINDBER

o/s Clyde E. Bounds
Secretary

By o/s Robert G. Machtley
President

The foregoing is a true copy of the original document.

Allison L. Bayles

EXHIBIT II

Report of Analysis of Coal

and

Washability Studies

by

Warner Laboratories, Inc.

Cresson, Pennsylvania

January 10, 1964

WARNER LABORATORIES, INC.

Established 1923

617 First Street
CRESSON, PA.

Phone Cresson 88-6-7400
Area Code 814

Lab. No. 271793
Date January 10, 1961

Received from Allison L. Bayles & Associates,
713 St. James Street,
Pittsburgh, Pennsylvania.

Sample Marked

Composite Sample of C Coal,
Float @ 1.60 ♂ raw - 20 mesh.

Date Sampled	Sampled by	Received at Laboratory
	M. Albert Evans	

REPORT OF ANALYSIS OF COAL.

	As Received	Dry Basis
% Moisture	0.98	xxxxx
% Volatile Matter	15.57	15.72
% Fixed Carbon	75.63	76.38
% Ash	7.82	7.90
	100.00	100.00
% Sulphur	1.20	1.21
B. t. u.	14,160	14,300
B. t. u. (Moisture & Ash Free)		15,527

Fusing Temperature of Ash 2780 °F.

Coke Button Index ASTM No. 3 1/2
Grindability (Hardgrove Index) 103

WARNER LABORATORIES, INC.

By Karl Costelnip

Filed 1964

EXHIBIT II

WARNER LABORATORIES, INC.

CRESSON, PENNA.

January 10, 1964

Allison L. Bayles & Associates
713 St. James Street
Pittsburgh, Pennsylvania

RECEIVED: December, 1963
January, 1964

REPORT

Sampled by M. Albert Evans

	Weight %	Ash	Sulphur
Sample 1A - 3A - 4A - 5A - 6A 1B - 3B - 4B - 5B - 6B			
Plus 20 Mesh Float @ 1.60	73.20 %	9.50 %	2.29 %
Sink @ 1.60	26.80	50.38	7.18
Calculated Analysis Raw Coal		20.59	3.60
Samples 1C - 3C - 4C - 5C - 6C			
Plus 20 Mesh Float @ 1.60	94.47 %	7.71 %	1.91 %
Sink @ 1.60	5.53	47.57	21.61
Calculated Analysis Raw Coal		9.92	2.15

WARNER LABORATORIES, INC.

By Karl Lindahl

EXHIBIT II

WARNER LABORATORIES, INC.

CRESSON, PENNA.

January 10, 1964

Allison L. Bayles & Associates
713 St. James Street
Pittsburgh, Pennsylvania

RECEIVED: December, 1963 January, 1964

REPORT

Sampled by M. Albert Evans

		Weight %	Ash	Sulphur
Sample 5 A	Plus 20 Mesh	83.51 %		
	Minus 20 Mesh	16.49		
		100.00 %		
Sample 5 B	Plus 20 Mesh	79.37 %		
	Minus 20 Mesh	20.63		
		100.00 %		
Sample 5 C	Plus 20 Mesh	86.92 %	11.07 %	3.24 %
	Minus 20 Mesh	13.08	8.51	2.22
		100.00 %		
Sample 6 A	Plus 20 Mesh	81.68 %		
	Minus 20 Mesh	18.32		
		100.00 %		
Sample 6 B	Plus 20 Mesh	91.86 %		
	Minus 20 Mesh	8.14		
		100.00 %		
Sample 6 C	Plus 20 Mesh	87.91 %	9.52 %	2.07 %
	Minus 20 Mesh	12.09	8.55	2.98
		100.00 %		
Samples 1A - 3A - 4A - 5A - 6A	Plus 20 Mesh			
	Minus 20 Mesh		10.28 %	2.34 %
Samples 1B - 3B - 4 B - 5B - 6B	Plus 20 Mesh			
	Minus 20 Mesh		17.96 %	1.86 %

WARNER LABORATORIES, INC.

By Karl Schelling

EXHIBIT II

WARNER LABORATORIES, INC.

CRESSON, PENNA.

January 10, 1964

Allison L. Bayles & Associates
713 St. James Street
Pittsburgh, Pennsylvania

RECEIVED: December, 1963 January, 1964

REPORT

Sampled by M. Albert Evans

		Weight %	Ash	Sulphur
Sample 1 A	Plus 20 Mesh	82.35 %		
	Minus 20 Mesh	17.65		
		100.00 %		
Sample 1 B	Plus 20 Mesh	92.77 %		
	Minus 20 Mesh	7.23		
		100.00 %		
Sample 1 C	Plus 20 Mesh	87.77 %	9.61 %	1.59 %
	Minus 20 Mesh	12.23	8.50	2.40
		100.00 %		
Sample 3 A	Plus 20 Mesh	81.26 %		
	Minus 20 Mesh	18.74		
		100.00 %		
Sample 3 B	Plus 20 Mesh	88.32 %		
	Minus 20 Mesh	11.68		
		100.00 %		
Sample 3 C	Plus 20 Mesh	86.56 %	10.08 %	2.48 %
	Minus 20 Mesh	13.44	8.46	2.50
		100.00 %		
Sample 4 A	Plus 20 Mesh	83.64 %		
	Minus 20 Mesh	16.36		
		100.00 %		
Sample 4 B	Plus 20 Mesh	91.82 %		
	Minus 20 Mesh	8.18		
		100.00 %		
Sample 4 C	Plus 20 Mesh	86.29 %	10.67 %	2.79 %
	Minus 20 Mesh	13.71	7.43	2.29
		100.00 %		

JAN 1964

WARNER LABORATORIES, INC.

By Karl Fredericks

EXHIBIT II

ALLISON L. BAYLES & ASSOCIATES

CONSULTING ENGINEERS

PRODUCT EVALUATION
FEASIBILITY STUDIES
PLANT LAYOUT
MANAGEMENT
OVERSEAS NEGOTIATIONS

713 SAINT JAMES STREET
PITTSBURGH, PENNSYLVANIA 15232
AREA CODE 412
TELEPHONE 682-4737

CABLE ADDRESS
BAYLES PITTSBURGHPENN
(U.S.A.)

1 April 1965

Mr. Frank A. Cirillo
Chief Technical Projects Manager
Area Redevelopment Administration
U. S. Department of Commerce
Washington, D. C. 20230

Reference: PR-30 - Project No. 675
Contract Cc-6114

Dear Mr. Cirillo:

It is a pleasure to transmit with this letter a Report entitled, "Supplement to Feasibility Study, Demonstration Mine Using Longwall Mining Techniques, Windber, Somerset County, Pennsylvania".

This Supplement, together with the Preliminary Report offered on 14 October 1964, will constitute a completed report described under Article I, Section D, Subsection 3.

We are of the impression that the Feasibility Study of the Demonstration Mine Using Longwall Mining Techniques has been submitted to interested parties and has received tentative approval without serious comment to alter the schedule.

The Feasibility Study plus the Supplement will present to ARA the method of bringing this project to fruition, the Supplement and the Feasibility Study to be treated as one and stand on their content.

Upon receipt of approval by you, with such comments as are pertinent to the substance of the report, the Consulting Engineers (the Contractor) will furnish the government with the necessary copies of the final report as prescribed in the Contract dated 20 December 1963 and subsequent amendments, and as agreed upon with Mr. I. M. Baill.

Faithfully yours,

Allison L. Bayles & Associates

Allison L. Bayles & Associates

Supplement

24 March 1965

Feasibility Study

DEMONSTRATION MINE

Using

LONGWALL MINING TECHNIQUES

Windber

Somerset County

Pennsylvania

U.S. DEPARTMENT OF COMMERCE
John T. Connor, Secretary

Eugene P. Foley, Assistant Secretary
and Director of Economic Development

INDEX

EXHIBITS

SUPPLEMENT

24 March 1965

This Supplement and the Feasibility Study of the Demonstration Mine Using Longwall Mining Techniques, submitted to the Area Redevelopment Administration on 14 October 1964, constitute the final report to be supplied to ARA. The purpose of the Supplement is to supply the following information:

1. The transition steps from the Feasibility Study necessary to achieve an operating mining property.

2. Capital requirements and the financial structure necessary to support the venture.

3. The projection of the results to be expected from the operation of the property.

1. The Transition

The Introduction to the Feasibility Study set out the task of the Consulting Engineers which would include, but not limit to, the following accomplishments:

> "Preliminary Investigation - Study the strata and seam characteristics in adjoining mines and consult with experienced operators of the same seam in the area to back up preliminary findings which were limited to the study of core drill data and highwall observations. - Take channel samples along the highwall and have a washability study made to determine the amount and type of cleaning necessary to meet the proposed market requirements.
>
> Select the seam and area for the second installation and study the strata and seam characteristics in order that the face equipment can be designed for both mining conditions.
>
> 1. Obtain options on the surface and coal.

2. Carry through the market survey to assure outlets for the product of this operation and secure commitments for the output.

3. Make surface surveys, surface and mine layouts, detailed plans and specification for mine, preparation plant, storage and rapid loading facilities, select equipment, prepare a definitive estimate of capital expenditures and prepare a projection of operating costs.

4. Select a coal company to operate the project through the first and second installations.

5. Prepare progress reports, a preliminary draft, a report on the trip (to the United Kingdom) and a final report.

6. Inspection of facilities in the United Kingdom.

The work was authorized on 20 December 1963."

As the work has progressed there have been changes in concept which will be described in the subsequent paragraphs.

The preliminary investigation cited above has been completed. The scene for the second installation has been selected. The options on the surface and coal, set out as Item 1 above and on Page ii of the Feasibility Study, have been obtained.

The market survey described in Item 2 above has been completed, but the commitments for the output of coal have not been secured. This matter is treated on Page 60 of the Feasibility Study. In brief, it was felt by the Consulting Engineers that though the coal would be marketable at the price selected for the study, it would be improper to secure commitments for the output, since it could be a usurpation of the prerogative of the coal mining company to be selected to operate the property.

The surface surveys, surface and mine layouts, detailed plans and specification for mine, preparation plant, storage and rapid loading facilities and selection of equipment, together with a definitive estimate of capital expenditures and a projection of operating costs described under Item 3 above, have been completed.

The coal company to operate the project through the first and second installations set out in Item 4 above has not been selected. Those considered have been unavailable or ineligible for reasons which need not be part of this report.

The trip to the United Kingdom contemplated under Item 5 above has become unnecessary for reasons which will become apparent.

Scrutiny of the Feasibility Study will disclose that it was planned originally to operate the selected property at Windber, described therein, until its coal became exhausted. At that time it was proposed to move the equipment to an appropriate property owned by the mining company operating the Demonstration Mine. Since the operators considered were either unavailable or ineligible, a different procedure has been adopted.

A company will be formed to operate the mine. This company will be composed of the representatives of the financing agencies, the Consulting Engineers and possibly the Coal Sales Agents and certain representatives of suppliers of equipment.

A contract will be made with the Consulting Engineers to select and oversee the operating management of the company, for a fee. In addition, the Consulting Engineers will issue statements as originally contemplated to disclose the mining costs of the venture to persons with bona fide interest.

The second location has been selected and consists of two parcels of property which are contiguous to that property described in the Feasibility Study. The topographic relationship of the three properties is set out in Drawing B-10-15, appended as Exhibit A - Optioned Areas 1, 2 and 3 - Proposed Demonstration Mine, East of Windber, Pennsylvania. The three properties have estimated available coal as indicated below. Corresponding recoverable coal is shown as Projected Coal Production.

	Estimated Available Coal	Projected Coal Production
Property #1	1,230,000	1,165,000
Property #2	1,270,000	1,236,400
Property #3	2,900,000	2,881,000
Total	5,400,000 Tons	5,283,000 Tons

This amount of coal is expected to be adequate to carry the project through the complete depreciation of the equipment.

It is possible that the options on the two additional pieces of property designated as No. 2 and No. 3 may not be exercised since certain other properties of larger magnitude may become available on an advantageous basis. However, it is reaffirmed that the properties presently optioned will carry the mine to the complete depreciation of the equipment, and the

figures displayed later herein are based on this premise.

The foregoing delineation sets out the changes which have been made in the project described in the Feasibility Study and enable consideration of the projections which follow.

2. Capital Requirements and the Financial Structure

There have been some changes in the capital investment required to make the property operative. These changes are set out and reconciled in Exhibit B - Investment Summary. It will be seen that the initial capital investment required is made up as follows:

Deposits	40,900
Cash	408,610
Leased Equipment	1,206,855
Total	1,656,365

The sources of funds to supply cash for initial capital expenditures are set out for this study as displayed below:

Leased Equipment	$1,206,855
Seven Year 8% Debentures	500,000
Capital Stock	125,000
Total	$1,831,855

The excess of $1,831,855 over $1,656,365 will be available for working capital.

Additional capital expenditures will be necessary in 1967 to the extent of $436,800 to utilize the second property and in 1968 in amount of $85,500 to utilize the third property. These amounts will be supplied from cash generated

by the operation of this mine.

3. The Projections of the Results to be expected from the operation of the property

There have been some changes in operating costs set out on Pages 49 and 50 of the Feasibility Study which are described and reconciled in Exhibit C - Expense Projections.

The sequence of steps and the time of occurrence to achieve the projected results are set out in Exhibit D - Time Table of Projected Operations and Production - Demonstration Mine. The exhibit and its footnotes are believed to be understandable without further discussion.

The reconciliation displayed and discussed in Exhibit C has been incorporated into the Projected Comparative Statement of Income and Retained Earnings, displayed as Exhibit E of this Supplement.

The Projected Source and Application of Funds Statement for the period treated in the projections is appended as Exhibit F.

The Comparative Balance Sheets for the period are displayed as Exhibit G.

These statements are appropriately footnoted so that they stand on their own content. They are intended to reflect the course of the projected operation of the mine from July 1965 through 1973, a period of eight and one-half years. This period will be adequate to permit writeoff of equipment by depreciation, the amortization of other expenses, and the liquidation of long term and other indebtedness, and yet provide for a return of 175% of the originally invested equity.

EXHIBITS

To The Supplement

Exhibit A - Map: Optioned Areas 1, 2 & 3.
Drawing B-10-15

Exhibit B - Investment Summary

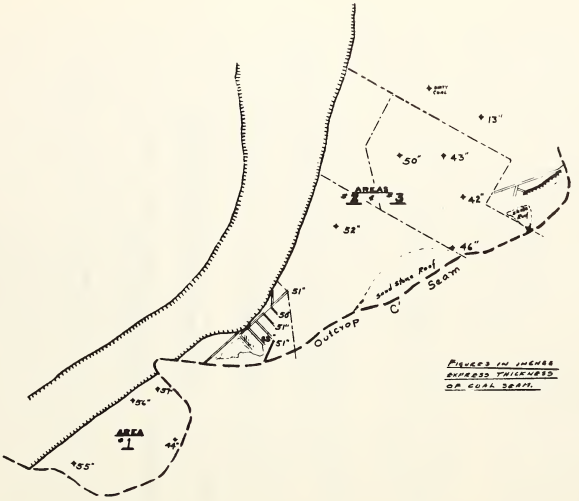
Exhibit C - Expense Projections
Reconciliation with Feasibility Study

Exhibit D - Timetable of Projected Operations
and Production

Exhibit E - Projected Comparative Statement
Of Income and Retained Earnings

Exhibit F - Projected Source and Application
Of Funds Statement

Exhibit G - Projected Comparative Balance Sheets



Proposed Demonstration Mine		
East of Windber		Penna
Scale: 1"=1000'	Approved by: M Albert Evans	Drawn by:
Date: 7-25-58		Revised:
Optioned Areas 1-2&3		
Allison L Bayles & Associates Pittsburgh Penna		B-10-15

Investment Summary

This Supplement contemplates a total investment in the Demonstration Mine of $2,178,665, exclusive of working capital. As indicated by statements made in the text (page 5) of this Supplement, the total investment consists of three parts - the initial investment, and two additional investments to be made later for the utilization of Property Areas 2 & 3, thus:

1.	Initial Investment	$1,656,365
2.	Additional Investment - Area 2	436,800
3.	Additional Investment - Area 3	85,500
		$2,178,665

I - Initial Investment

The initial investment projected in this Supplement contains expenditures amounting to $43,200 not contemplated in the original study. The Investment Summary contained in page 59 of the Feasibility Study has been revised to include these additions. The revised form is exhibited herein as: Initial Investment - Revised Summary. It has been condensed to display only totals for categories in which no revision is made, namely: Surface; Underground; and Longwall Operations. Where additions have been made the affected items are marked by an asterisk (*). A detailed accounting of the additions follows the Summary under the caption - Additions Included In Revised Investment Summary. The latter in turn is followed by analyses of deposits and cash investment identified as: Analysis of Recoverable Deposits; and Analysis of Initial Cash Investment.

Initial Investment - Revised Summary

	Deposit	Cash	Lease[7]	Total
Initial Development Period				
General	$40,900*	$ 20,700*	-	$ 61,600
Surface	-	228,950	$ 117,775	346,725
Underground	-	7,960	325,670	333,630
Total - Initial Development Period	40,900	257,610	443,445	741,995
Longwall Operation	-	25,000	763,410	788,410
Total	40,900	282,610	1,206,855	1,530,365
Allowance for Contingency[1]	-	50,000	-	50,000
Engineering[1]	-	76,000*	-	76,000
Grand Total	$40,900	$408,610	$1,206,855	$1,656,365

Additions Included in Revised Investment Summary

	Deposit	Cash	Total	Notes
Deposit on Compensation Insurance Policy	$ 5,000	-	$ 5,000	(2)
Core Drilling - Areas 2 & 3	-	$ 9,000	9,000	(3)
Organization Expense	-	1,200	1,200	(4)
Engineering	-	28,000	28,000	(5)
Total - Additional Expenditures	$ 5,000	$ 38,200	$43,200	
Previous Total Expenditure	35,900	370,410		(6)
Revised Total Expenditures	$40,900	$408,610		
Grand Total - Previous			$1,613,165	
Grand Total - Revised			$1,656,365	

Notes

(1) If actually invested the Contingency Allowance would generate a corresponding element of expense to be met in the conduct of operations. Conservative treatment of expense projections requires inclusion of such an element. Hence the Contingency Allowance is treated as one of the expenditures making up the initial investment. In the original Investment Summary neither the Contingency Allowance nor Engineering were classified under any of the three types of investment - Deposit, Cash or Lease. Both are now classified as cash investment in assets subject to either depreciation or depletion with attendant generation of expense which is incorporated in the operating projections of this Supplement.

(2) By original expectation the Demonstration Mine would have been operated by a company having other mining operations with a compensation insurance policy already in effect. This would allow inclusion of the proposed operation without further deposit. The new company proposed under the present plan will be required to post a deposit. Refer Feasibility Study, page 53.

(3) The original study contemplated operations and core drilling Area 1 only. With the inclusion of Areas 2 & 3 additional core drilling is necessary.

(4) Organization Expense represents the estimated cost of establishing a new corporate entity to operate the Demonstration Mine. Such expenditure was not required under the original plan for operation by an existing company.

(5) The $28,000 addition to Engineering is predicated on the greater magnitude of the project as now contemplated.

(6) The $370,410 previous total cash expenditure is not present as a separate figure in the original Investment Summary, page 59 of the Study. It will appear upon addition of Allowance for Contingency and Engineering to those items which are listed as cash investment, thus:

Notes

(6) (Continued)

Total Cash Investment as set forth in original Investment Summary, page 59 of the Feasibility Study	$272,410
Add Cash Items shown in the original Summary but not included in the foregoing total:	
Allowance for Contingency	50,000
Engineering	48,000
Total Cash Investment including items listed but not classified as Cash items in the original Summary.	$370,410

(7) No changes have been made in the lease amounts contemplated by the Feasibility Study. However, modifications have been made which relate to lease periods and carrying charges. Refer to Equipment Leasing Terms, Section III of this exhibit.

Analysis of Recoverable Deposits

Item	Amount	Reference
Legal - Permits - Bonds	$ 1,000	(a) p. 53
Compensation Insurance Deposit	5,000	(c)
Coal Lease Deposit	10,000	(a) p. 53
Siding Extension Sub-grade	9,900	(a) p. 53
Siding Extension Track	15,000	(a) p. 53
Total Deposits	$40,900	

References:
(a) - Feasibility Study
(c) - Additions Included in Revised Investment Summary

Analysis of Initial Cash Investment

Item	Amount of Initial Cash Investment: Plant & Equipment	Development	Other	Total	Reference
General					
10 Core Drill Holes - Area 1	-	2,000	-	2,000	(a) p. 53
Core Drilling - Areas 2 & 3	-	9,000	-	9,000	(c)
Grading - Drainage - Roads	3,000	-	-	3,000	(a) p. 53
Legal - Permits - Bonds	500	-	-	500	(a) p. 53
Power Line to Plant	5,000	-	-	5,000	(a) p. 53
Organization Expense	-	-	1,200	1,200	(c)
Total - General	8,500	11,000	1,200	20,700	(b)
Surface					
Temporary - #1 Butt Entry Development	12,400	-	-	12,400	(a) p. 53
Raw Coal Transportation	46,550	-	-	46,550	(a) p. 53
Cleaning Plant	107,200	-	-	107,200	(a) p. 53
Clean Coal Storage and Loading	51,200	-	-	51,200	(a) p. 54
Miscellaneous	11,600	-	-	11,600	(a) p. 54
Total - Surface	228,950			228,950	(b)
Underground					
Miscellaneous	5,160	-	-	5,160	(a) p. 54
Power	800	-	-	800	(a) p. 55
Development	-	2,000	-	2,000	(a) p. 56
Total - Underground	5,960	2,000		7,960	(b)
Longwall Operation					
Longwall Equipment Installation	-	8,000	-	8,000	(a) p. 58
Training Period	-	17,000	-	17,000	(a) p. 58
Total - Longwall Operation		25,000		25,000	(b)
Allowance for Contingency	50,000	-	-	50,000	(b)
Engineering	-	76,000	-	76,000	(b)
Grand Total	293,410*	114,000	1,200	408,610	(b)

* This investment in Plant & Equipment is exclusive of any of the investment in Leased Equipment which is shown in References (a) & (b).

References: (a) - Feasibility Study
(b) - Initial Investment - Revised Summary
(c) - Additions Included in Revised Investment Summary

The makeup of the additional investments required for utilization of Property Areas 2 & 3 is displayed in the following schedule. Investment will be made in 1967 for Area 2 and in 1968 for Area 3 in conformity with the timetable of Exhibit D.

Additional Capital Investment - Areas 2 & 3

	Area 2			Area 3		
	Plant & Equipment	Develop-ment	Total	Plant & Equipment	Develop-ment	Total
General & Surface						
Grading, Roads	-	$30,000	$30,000	-	$18,000	$18,000
Surface Power Line	$ 10,000(a)	-	10,000	$ 7,000	-	7,000
Truck Bin	18,000(a)	-	18,000	21,000	-	21,000
Shop - Supply, Lamp House	4,500(a)	-	4,500	6,000	-	6,000
Main Ventilating Fan	1,000(a)	-	1,000	-	-	-
Underground						
Mine Openings	-	1,000	1,000	-	1,000	1,000
Transportation Equipment						
Coal	181,000(b)	-	181,000	-	1,000	1,000
Men & Supplies	18,500(b)	-	18,500	28,500	1,500	30,000
Development & Equipment - Wilcox Type	120,000(b)	-	120,000	-	-	-
Power - Substation, Transformers, Cable	40,600(b)	-	40,600	-	-	-
Bore Hole, Pump & Reservoir	1,500(a)	-	1,500	1,500	-	1,500
High Pressure Water System	2,800(b)	-	2,800	-	-	-
Rock Duster	1,000(a)	-	1,000	-	-	-
Fire Extinguishers & First Aid Equip.	500(b)	-	500	-	-	-
Belt Fire Protection	1,400(a)	-	1,400	-	-	-
Communications Equipment	4,500(b)	-	4,500	-	-	-
Tools	500(a)	-	500	-	-	-
Total Investment	$405,800	$31,000	$436,800	$64,000	$21,500	$85,500

Total (a) - Plant & Equipment for Area 2 Operations Only $ 37,900

Total (b) - Equipment for Area 2, Also Used for Area 3. 367,900

Total 405,800

III - Equipment Leasing Terms

Lease periods and carrying charges (interest) as originally contemplated have been somewhat modified. The schedule of Lease Projections appearing in page 51 of the Feasibility Study has been revised to incorporate the modifications. The revised schedule follows:

Lease Projections	Equipment Cost	Lease Period	Period of Principal Reduction	Monthly Rentals*
Surface Equipment	$ 117,775	28 Mos.	20 Mos.	$ 6,380
Development Equipment	325,670	56 Mos.	48 Mos.	8,142
Longwall Equipment	763,410	50 Mos.	48 Mos.	19,085
	$1,206,855			$33,607

It will be understood that the revisions also apply to Footnote (6) of the Schedule of Overhead Expense contained in page 50 of the Feasibility Study.

The modifications are made in order to satisfy delivery requirements for Surface Equipment according to the operating timetable set out in Exhibit D, and to conform to recent practice of equipment lessors. In more detail, the modifications are:

(1) Extension by two months at the beginning of the lease period of the Surface Equipment lease. The period of principal reduction and time of lease termination remain unchanged.

(2) Extension by four months of the period of principal reduction for Development Equipment and Longwall Equipment. Times of beginning of the lease periods are unchanged.

(3) Carrying charges are now computed on the basis of an annual interest rate of 5% of the initial amount of lease (Equipment Cost) without diminution throughout the life of the lease, rather than on the former basis of a 10% annual interest rate in each year on the unpaid balance of the lease amount existing at the beginning of the year.

* Total monthly payment on account of each lease, during the period of principal reduction, including carrying charges (interest).

These modifications are cited as an accounting for deviations of the present projections from the Feasibility Study. They are of no significant effect on the project as a whole. The greatest effect is due to the levelling out of carrying charges during lease periods. Thereby such charges are somewhat reduced in the earlier part and increased in the later part of a lease period. This lessens, to some extent, the working capital required during the interval before operations become profitable. Total carrying charges are slightly less than they would have been on the original basis.

IV - Capital Requirement and Sources of Funds for Operating Company

Operation of the Demonstration Mine will be carried on by a new company formed for the purpose. It is considered that the company will have need for capital funds as follows:

Capital Requirement of Operating Company *

Initial Investment - Revised Summary - Page 2 of this Exhibit:

Deposits (Cash)	$ 40,900
Cash Investment	408,610
Total Initial Investment	449,510
Initial Working Capital	175,490
Total Capital Requirement	$625,000

The funds would be supplied by the following sources in the amounts stated.

Sources of Funds

Capital Stock	$125,000
Seven Year 8% Debenture Notes	500,000
Total Funds Supplied	$625,000

This capital structure is shown and noted in the projected Balance Sheets of Exhibit G. Interest on the Debenture Notes is shown among Overhead Expense in the Income Statements of Exhibit E.

* It will be understood that the investment of $1,206,855 in leased equipment will be made by the lessor of the equipment, not by the operating company.

Expense Projections
Reconciliation With Feasibility Study

I - Operating Expense

Operating Expenses in dollars per year are projected in the Comparative Income Statement, Exhibit E of this Supplement, on the basis of unit costs set forth in detail in the schedule, Estimated Costs Per Ton, page 49 of the Feasibility Study, with adjustment where needed to reflect differing conditions. For comparison, both the rates from the Feasibility Study and those used in the projection of income are set out in the tabulation, Operating Expense Rates, which appears on a subsequent page hereof. Adjustments are noted.

The adjustments are primarily due to differences between the three Properties, #1, #2 and #3, which affect the transport of coal from the working face in the mine to the point of loading on rail cars. Operations for Property #1 are based on fully conveyorized transport. For Properties #2 and #3 it is projected that surface transport will require trucking by a contract hauler and the estimated cost thereof is shown as a separate figure. For Property #3 the distance of underground transport by conveyor is relatively much greater than for Properties #1 and #2. Rates for projection purposes are adjusted to reflect the resulting increase in the requirement for labor and electric power for operation on Property #3.

Operations listed as Butt Entry Development refer to development work which necessarily precedes the beginning of

longwall operation in each property. Operations listed as Longwall Operation include, in addition to actual working of the longwall face, the butt entry work which accompanies and proceeds simultaneously with the longwall working. Room and Pillar Operation listed on Property #2 refers to the use of development equipment to remove coal from a relatively small area not suited to longwall operation.

For those years in which it is projected that only one of the listed operations will be carried on, the listed rates can be derived from the Projected Income Statement by dividing annual production tonnage into the operating expense figure. For any year in which more than one of the listed operations are projected such computation will yield the weighted average rate for the particular combination of operations involved rather than the listed rates for the individual operations.

Operating Expense Rates

Operations Detailed In Table of Estimated Costs, Feasibility Study, page 49.	Estimated Cost Per Ton Labor	Supplies	Trucking	Total	Notes
Butt Entry Development	$2.170	$0.899	-	$3.069	
Longwall Operation-Training Period	2.606	0.830	-	3.436	(1)
Longwall Operation-Normal Production	1.271	0.487	-	1.758	
Operations Projected In Comparative Income Statement, Exhibit E of this Supplement					
Property #1					
Butt Entry Development-1965	$2.170	$0.899	-	$3.069	
Longwall Operation-Training 1966	2.059	0.800	-	2.859	(2)
Longwall Operation(After Training)1966-67	1.271	0.487	-	1.758	
Property #2					
Butt Entry Development-1967	1.960	1.100	0.250	3.310	(3)
Longwall Operation-1967	1.271	0.487	0.250	2.008	
Longwall Operation Combined with Room and Pillar Operation-1968	1.368	0.546	0.250	2.164	(4)
Properties #2 and #3					
Longwall Operation Property #2 Combined with Butt Entry Development Property #3-1969	1.368	0.546	0.250	2.164	(4)
Property #3					
Longwall Operation-1969-70	1.301	0.547	0.300	2.148	(5)
Longwall Operation-1971-72	1.291	0.527	0.300	2.118	(5)
Longwall Operation-1973	1.281	0.507	0.300	2.088	(5)

Notes - Refer Page 4.

Operating Expense Rates

Notes:

(1) Unit Costs are based on a production of 900 Tons per Day.

(2) Unit Costs adjusted to the production of 1,200 Tons per Day as shown in Exhibit D of this Supplement.

(3) Compare total cost exclusive of Trucking ($3.060) with total cost of $3.069 above for Property #1 and in Feasibility Study.

(4) Computation will show that combined costs are substantially equivalent to the costs of the same operations taken separately.

(5) Underground transport over greater distance in Property #3 increases the requirement for labor and electric power over the requirements of Properties #1 and #2. The additional requirement diminishes with decreasing transport distance as the working face retreats. The increase in cost due to this factor is estimated as follows:

	Increase		
	In Labor Cost	In Supply Cost	In Total Cost
1969-1970	$0.030/Ton	$0.060/Ton	$0.900/Ton
1971-1972	0.020/Ton	0.040/Ton	0.600/Ton
1973	0.010/Ton	0.020/Ton	0.300/Ton

II - Overhead Expense

Overhead Expenses in dollars per year are projected in the Comparative Income Statement, Exhibit E of this Supplement, in the manner described in this section.

The schedule, Estimated Costs per Ton, Overhead, which appears in page 50 of the Feasibility Study, is a complete and proper statement in terms of unit costs, or rates (hereafter called Original Rates) of overhead expenses of the Demonstration Mine as the operation was originally contemplated. That statement is utilized, in part, for present purposes.

In the projection of pro-forma operating statements for the operation as now conceived, in three properties and over a period of $8\frac{1}{2}$ years, there are to be taken into account several considerations which were not germane to the Feasibility Study. These points, listed for later reference, are:

(1) Timetable of Operations. Definite periods of time, as below, have been assigned to operation in each of the three areas. Refer Exhibit D.

Area	Operating Period*
1	July 1965-October 1967
2	April 1967-June 1969
3	November 1968-December 1973

Attention is directed to the overlap in time, by several months in each instance, of one period upon another.

*Periods include both months named.

(2) Revised Lease Projection. Equipment leasing terms have been revised both as to lease periods and carrying charges (Interest). Refer Exhibit B, page 7, III-Equipment Leasing Terms.

Revised lease periods are given below. Dates shown are compatible with the foregoing Time-table of operations.

Lease	Interest Begins	Period of Principal Reduction*
Surface Equipment	May 1965	March 1966-October 1967
Development Equipment	June 1965	March 1966-February 1970
Longwall Equipment	January 1966	March 1966-February 1970

* Periods include both months named.

(3) Initial Investment-Revised Summary and Additional Capital Investment-Areas 2 & 3.

Refer Exhibit B, pages 2 and 6.

(4) Adaptation to Change of Operator.

(5) Deferred Operating Expense-Limitation for Tax Purposes.

Expenses Projected at Original Rates

Certain Original Rates are unaffected by the foregoing points. They are applicable throughout the $8\frac{1}{2}$ year period and have been used as the basis for projection of expenses in the Income Statements of Exhibit E, namely:

Coal Royalty
Insurance-Plant & Equipment
Surface Rental*

*The rate is based on $50 per month expressed to the nearest mil which produces some uneven amounts. Expense figures have been rounded to the $50 basis.

By reason of Point (1) above the Original Rates for Taxes on Improvements have been adjusted:

Adjusted Rates Used in Projection of Taxes on Improvements	
1965	$0.009 per ton
1966-67	0.003
1968-70	0.004

Depreciation, Depletion, Equipment Rental
Reconciliation with Feasibility Study

Annual Depreciation and Depletion charges shown in the Income Statements of Exhibit E have been computed directly, using as bases the several investments and the respective periods over which they are written off (Points (1) and (3) above) rather than by means of any unit rates. Dates upon which the various groups of Plant & Equipment representing initial and later investments will become fully depreciated, are given in Note 7 to the Balance Sheets of Exhibit G.

In similar manner, leasing costs, separated into Leased Equipment-Rental (Reduction of Principal) and Leased Equipment-Interest, have been computed directly from the basic data (Point (2) above) rather than by means of unit rates. The schedule of equipment deliveries contained in Note 14 to the Income Statements of Exhibit E has been used in determining interest charges prior to March 1966.

It is the purpose of this exhibit to point out and reconcile differences between Original Rates of the Feasibility Study and expenses as now projected. For depreciation, depletion and equipment leasing expenses, means to make a direct comparison of unit rates are lacking. Hence, comparison is made in another manner.

In the Feasibility Study, page 50, Depreciation and Depletion are combined into a single item; Contingencies and Engineering are separate items; Equipment Rental includes both reduction of principal and interest. In the Income Statements,

Exhibit E, Depreciation and Depletion are separate items; Depreciation includes Contingencies and Depletion includes Engineering; Equipment Rental (Principal Reduction) and Interest are separate items.

The year 1966 is concerned solely with Area 1, there being no overlap with operations in Area 2 (Point (1) above). For the subject items the expense amounts in total dollars for the year 1966 have been computed on the basis of original rates, using the production tonnages set out in page 48 of the Feasibility Study. These amounts are compared with figures for corresponding items, combinations and separations considered, for 1966 in the Income Statements of Exhibit E, as follows:

1966 Expenses Computed According to Feasibility Study

Depreciation & Depletion	$110,640
Contingencies (Capital)	26,600
Engineering	23,288
Total Depreciation, Depletion, Contingencies and Engineering	$160,528
Equipment Rental (Including Principal and Interest)	$390,856

1966 Expenses Projected in Income Statement, Exhibit E

Depreciation-Plant & Equipment	$125,747
Depletion of Development	50,363
Total Depreciation & Depletion (Including Contingencies and Engineering)	$176,110
Leased Equipment-Rental	$285,780
Interest	60,343
Total Rental & Interest	$346,123

Depletion charges shown in the Income Statement reflect increases in the initial cash investment in Development

of $9,000 for Core Drilling and $28,000 for Engineering (Refer Exhibit B, page 2, Additions Included in Revised Investment Summary) - a total increase of $37,000. Some 40%, or $14,800, of this increase is contained in the 1966 expense figure. This increase, which is due to present revisions, did not enter into the Original Rates. Comparing the totals shown above:

Depletion & Depreciation - 1966

According to Income Statement, Exhibit E	$176,110
According to Feasibility Study	160,528
Increase as compared to Feasibility Study	$ 15,582

Noting that one mil on the tonnage involved amounts to $568 and that a number of Original Rates (rounded to the nearest mil) are involved in the computation, it is considered that the Feasibility Study and the 1966 Income Statement are fully reconciled as to Depreciation and Depletion charges.

For 1966, Equipment Rental (Principal and Interest) has been reduced by $3,503 per month ($37,110 less $33,607). Refer Feasibility Study, page 51, and Exhibit B, page 7. The interest rate has been reduced from 10% to 5% on $1,206,855 of equipment cost. Payments in 1966 include 10 months at full rental and two months of interest only. Refer Point (2) above. The reduction to be expected in equipment leasing costs is:

10 Months @ $3,503	$35,030
2 Months @ 5/12% per month on $1,206,855	10,057
Expected Reduction	$45,087

Comparing the totals previously shown:

Equipment Leasing Costs - 1966

According to the Feasibility Study	$390,856
According to Income Statement, Exhibit E	346,123
Decrease as compared to Feasibility Study	$ 44,733

It is considered that the Feasibility Study and the 1966 Income Statement are fully reconciled as to Equipment Leasing Costs.

Depreciation, Depletion and Leasing Costs are major items among overhead expenses. Revisions affecting these items have been made which have the effect for 1966 of reducing Leasing Costs by $44,733 and increasing Depreciation & Depletion by $15,582, a net reduction of $29,151. The latter amount is 3.5% of the $835,811 total Overhead Expense projected for the year 1966 in Exhibit E. A reduction of this magnitude is of no great significance to the project as a whole.

Adaptation of Overhead Expense to Change of Operator

It was originally contemplated that operation of the Demonstration Mine would be carried on by an existing firm well established in the business of coal mining. As presently conceived, operations will be conducted by a new company organized for the purpose. This change (Point (4) above) has been taken into account in projecting overhead expenses in the Income Statements of Exhibit E, as follows:

Sales - As originally conceived, sales were to be the province of the sales organization of the operator whose established sales contacts would be adequate for the purpose. Sales expense, accordingly, was treated as an overhead expense item for which

the Original Rate is $0.150 per ton. As now projected sales would be conducted by a separate selling organization, having established sales contacts, on a 5½% commission basis. In the Income Statements, Exhibit E, the sales commission is treated as a deduction from Coal Sales and does not appear as an item of Overhead Expense. The 5½% commission based on a selling price of $4.10 per ton corresponds to a rate of $0.2255 per ton.

Administration - The Original Rate of $0.150 per ton reflects the concept of an established operator. It would not cover the administration expense of the new company during the early months of low tonnage output. For purposes of projection the rate has been increased to $0.730 during 1965, $0.291 during January and February 1966, reverting to the Original Rate of $0.150 in March 1966 and thereafter.

Association Dues - It will be advantageous for the new company to hold membership in the Central Pennsylvania Coal Producers Association. The dues are based on coal produced at a rate of $0.004 per ton, which rate is the basis for projection in Exhibit E. This item of Overhead Expense was not contemplated by the Feasibility Study.

Interest-Debenture Notes - This is a financial expense related to the capital structure of the new company. Interest, according to the terms of issue and the retirement schedule of the Notes, has been included in projected Overhead Expenses of Exhibit E. Refer Exhibit G, Note 12.

Deferred Operating Expense
Limitation for Tax Purposes

The several kinds of equipment which contribute to Deferred Operating Expense are listed in the schedule in page 50 of the Feasibility Study. This equipment requires periodic expenditures for major overhaul and replacements in amounts ranging from about $15,000 to more than $200,000 per occurrence according to the kind of equipment involved. Intervals between occurrences run from 2 years or less to 6 years for the different kinds of equipment. (Refer Footnotes (1)-(5) to the same schedule in page 50 of the Study). Rates shown in the schedule spread the expenditures over their corresponding periods on a tonnage basis. By this levelling of peaks and valleys, widely ranging annual expenditures are expressed as averages which remain stable.

For example, if a certain kind of equipment required an expenditure of $100,000 every four years, at normal operating levels, Deferred Operating Expense for that equipment would be $25,000 per year. Actual expenditure would be zero for three years and $100,000 in the fourth year. For purposes of comparison and the viewing of expense on a long term basis Deferred Operating Expense figures are more useful than the widely ranging annual figures.

When computed at the Original Rates of the Study, total Deferred Operating Expense for the year 1966 amounts to $149,132. In the Income Statement, Exhibit E, the actual

expenditure listed as Deferred Operating Expense for the year 1966 is $50,200. It will be understood that in different ways both figures are proper statements of the expense. Figures in the Income Statement are projected actual expenditures, not deferred expense. The caption, Deferred Operating Expense, has been retained to indicate that the item bears some relation to the like named item in the Feasibility Study.

By treating periodic expenditures as averages over their respective periods, Deferred Operating Expense has the effect of bringing forward into earlier years substantial amounts of expense for which the actual outlay of funds will be made in later years. This treatment of expense is inadmissible for Federal Income Tax purposes (Point (5) above). The actual expenditures are fully allowable as expense in the year of occurrence.

Annual expenses shown as Deferred Operating Expense in the Income Statements of Exhibit E are total actual expenditures projected on the basis of rates which take account of both the periodicity and differing amounts of expenditures relating to the several sources of deferred expense cited in page 50 of the Feasibility Study. As would be expected the rates vary widely from year to year. The rate for any year is applied to the total tonnage of coal produced during the year. The rates used are listed on the following page.

Deferred Operating Expense Rates By Years

		Dollars Per Ton
1965	-	-
1966	-	$0.087
1967	-	0.120
1968	-	0.090
1969	-	0.082
1970	-	0.585
1971	-	0.170
1972	-	0.250
1973	-	0.115

TIMETABLE OF PROJECTED OPERATIONS & PRODUCTION

EXHIBIT D

Demonstration Mine

Year	Period	Area[1]	Operations	Coal Produced - Clean Coal Basis - Tons				
				Per Day[2]	Total	Area 1	Area 2	Area 3
1965	3 Mo. April-June	1	Construction & Development	-	-	-	-	-
	6 Mo. July-Dec.	1	Butt Entry Development	480	57,600	57,600	-	-
1966	2 Mo. Jan.-Feb.	1	Training - Longwall Operation	1,200	48,000	48,000	-	-
	10 Mo. Mar.-Dec.	1	Longwall Operation	2,900	530,000	530,000	-	-
			Total 1966	-	578,000			
1967	10 Mo. Jan.-Oct.	1	Longwall Operation	2,900	530,000	530,000	-	-
	9 Mo. Apr.-Dec.	2	Butt Entry Development	480	86,400	-	86,400	-
	2 Mo. Nov.-Dec.	2	Longwall Operation	2,900	106,000	-	106,000	-
			Total 1967	-	722,400			
1968	10 Mo. Jan.-Oct.	2	Room & Pillar Operation	480	90,000	-	90,000	-
	12 Mo. Jan.-Dec.	2	Longwall Operation	2,900	636,000	-	636,000	-
	2 Mo. Nov.-Dec.	3	Butt Entry Development	480	18,000	-	-	18,000
			Total 1968	-	744,000			
1969	6 Mo. Jan.-June	3	Butt Entry Development	480	54,000	-	-	54,000
	6 Mo. Jan.-June	2	Longwall Operation	2,900	318,000	-	318,000	-
	6 Mo. July-Dec.	3	Longwall Operation	2,900	318,000	-	-	318,000
			Total 1969	-	690,000			
1970	11 Mo. Jan.-Dec.	3	Longwall Operation[3]	2,900	583,000	-	-	583,000
1971	12 Mo. Jan.-Dec.	3	Longwall Operation	2,900	636,000	-	-	636,000
1972	12 Mo. Jan.-Dec.	3	Longwall Operation	2,900	636,000	-	-	636,000
1973	12 Mo. Jan.-Dec.	3	Longwall Operation	2,900	636,000	-	-	636,000
			Grand Total 1965-73		5,283,000	1,165,600	1,236,400	2,881,000

(1) Areas relate to like numbered Mine Properties.
(2) Production rates are as set forth in the Production Summary, page 48 of the Feasibility Study, except for the Longwall Training Period which rate is now projected at 1200 tons per day. Production is projected on the basis of 20 operating days per month for the period July 1965 - June 1966 and 18-1/3 days per month (220 days per year) thereafter.
(3) Operations suspended 1 month during year for the overhauling of Longwall Roof Supports.

24 March 1965

EXHIBIT D

PROJECTED COMPARATIVE STATEMENT
OF INCOME & RETAINED EARNINGS

EXHIBIT E
Page 1

Demonstration Mine

	1965 (6 Mos.)	1966	1967	1968	1969	1970	1971	1972	1973	1965-73 Total	Notes
Coal Produced - Tons	57,600	578,000	722,400	744,000	690,000	583,000	636,000	636,000	636,000	5,283,000	(2)
Coal Purchased - Tons	18,000	63,000	66,000	66,000	66,000	66,000	66,000	66,000	66,000	537,500	(3)
Coal Shipped - Tons	75,600	641,000	788,400	810,000	756,000	649,000	702,000	702,000	702,000	5,820,500	(4)
Coal Sales @ $4.10/Ton	309,960	2,628,100	3,232,440	3,321,000	3,099,600	2,660,900	2,878,200	2,878,200	2,878,200	23,886,600	(5)
Less Commissions - 5½%	17,048	144,546	177,784	182,655	170,478	146,349	158,301	158,301	158,301	1,313,763	(6)
Coal Sales - Net	292,912	2,483,554	3,054,656	3,138,345	2,929,122	2,514,551	2,719,899	2,719,899	2,719,899	22,572,837	
Operating Expense											
Labor & Fringe Benefits	124,992	772,462	977,700	1,017,792	922,614	758,483	821,076	821,076	814,716	7,030,911	(7)
Supplies	51,782	296,510	404,772	406,224	377,058	318,901	335,172	335,172	322,452	2,848,043	(8)
Trucking (Contract)	-	-	48,100	186,000	188,400	174,900	190,800	190,800	190,800	1,169,800	(9)
Total Operating Expense	176,774	1,068,972	1,430,572	1,610,016	1,488,072	1,252,284	1,347,048	1,347,048	1,327,968	11,048,754	
Overhead Expense											
Deferred Operating Expense	-	50,200	86,580	66,960	56,580	341,000	108,120	159,000	73,200	941,640	(10)
Depletion of Development	4,645	50,363	58,075	19,473	16,050	5,411	4,161	4,161	4,161	166,500	(11)
Depreciation - Plant & Equipment	62,874	125,747	127,362	78,569	80,470	72,047	72,047	72,047	72,047	763,210	(12)
Leased Equipment - Rental	-	285,780	331,153	272,268	272,268	45,386	-	-	-	1,206,855	(13)
Interest - 5%	9,481	60,343	59,902	54,454	54,454	9,076	-	-	-	247,710	(14)
Coal Royalty	11,520	115,600	144,480	148,800	138,000	116,600	127,200	127,200	127,200	1,056,600	(15)
Insurance - Plant & Equipment	1,330	9,440	10,890	11,390	11,390	8,160	8,900	8,900	8,900	79,300	(16)
Interest - Debenture Notes - 8%	30,000	40,000	34,000	26,000	18,000	10,000	2,000	-	-	160,000	(17)
Taxes on Improvements (Buildings)	518	1,926	2,100	2,976	2,760	2,544	2,544	2,544	2,544	20,456	(18)
Surface Rental	450	600	600	600	600	600	600	600	600	5,250	(19)
Association Dues	230	2,312	2,890	2,976	2,760	2,332	2,544	2,544	2,544	21,132	(20)
Administration	42,000	93,500	108,360	111,600	103,500	95,400	95,400	95,400	95,400	840,560	(21)
Total Overhead Expense	163,048	835,811	966,392	796,066	756,832	708,556	423,516	472,396	386,596	5,509,213	
Total Expense	339,822	1,904,783	2,396,964	2,406,082	2,244,904	1,960,840	1,770,564	1,819,444	1,714,564	16,557,967	
Purchased Coal @ $3.30/Ton	59,400	207,900	217,800	217,800	217,800	217,800	217,800	217,800	217,800	1,791,900	(3)
Total Cost	399,222	2,112,683	2,614,764	2,623,882	2,462,704	2,176,640	1,988,364	2,037,244	1,932,364	18,349,867	
Net Income (Loss)	(106,310)	370,871	439,892	514,463	466,418	335,911	731,535	682,655	787,535	4,222,970	
Income Tax - Federal & State	-	53,732	125,464	147,839	133,425	94,274	263,364	236,969	293,604	1,348,671	
Net Income After Tax (Loss)	(106,310)	317,139	314,428	366,624	332,993	241,637	468,171	445,686	493,931	2,874,299	

General Note (1)

Notes to Exhibits E, F & G, in that order,
appear in the pages following Exhibit G.

PROJECTED COMPARATIVE STATEMENT
OF INCOME & RETAINED EARNINGS

Demonstration Mine

	1965 (6 Mos.)	1966	1967	1968	1969	1970	1971	1972	1973	1965-73 Total	Notes
Net Income After Tax (Loss) - Carried Forward from Page 1	(106,310)	317,139	314,428	366,624	332,993	241,637	468,171	445,686	493,931	2,874,299	
Retained Earnings - Beginning Balance	-	(106,310)	210,829	494,007	829,381	1,131,124	1,341,511	1,778,432	2,192,868		
	-	210,829	525,257	860,631	1,162,374	1,372,761	1,809,682	2,224,118	2,686,799		
Less Dividends Paid	-	-	31,250	31,250	31,250	31,250	31,250	31,250	31,250	218,750	(22)
Retained Earnings - Ending Balance	(106,310)	210,829	494,007	829,381	1,131,124	1,341,511	1,778,432	2,192,868	2,655,549		
Income Deductions & Tax Incidence											
Net Income		370,871	439,892	514,463	466,418	335,911	731,535	682,655	787,535	4,329,280	
Less Income Deductions for Federal Tax:											
Loss Carried Forward		106,310	-	-	-	-	-	-	-	106,310)	
*Depletion Allowance		185,435	219,946	257,232	233,209	167,955	260,760	260,760	260,760	1,846,057)	(23)
Total Deductions		291,745	219,946	257,232	233,209	167,955	260,760	260,760	260,760	1,952,367)	
Income Subject to Federal Income Tax		79,126	219,946	257,231	233,209	167,956	470,775	421,895	526,775	2,376,913)	
Federal Income Tax - 1965 Rates		31,480	99,074	116,971	105,440	74,119	219,472	196,010	246,352	1,088,918	(23)
Pennsylvania Income Tax		22,252	26,390	30,868	27,985	20,155	43,892	40,959	47,252	259,753	(24)
Total Income Tax - Federal & State		53,732	125,464	147,839	133,425	94,274	263,364	236,969	293,604	1,348,671	
*Applicable Depletion Allowance: Amount A below, but not more than Amount B.											
Gross Sales of Coal Produced		2,369,800	2,961,840	3,050,400	2,829,000	2,390,300	2,607,600	2,607,600	2,607,600	21,660,300)	
A = 10% of Gross Sales of Coal Produced		236,980	296,184	305,040	282,900	239,030	* 260,760	* 260,760	* 260,760	)	(23)
B = 50% of Net Income		* 185,435	* 219,446	* 257,232	* 233,209	* 167,955	365,768	341,378	393,768	)	

Notes to Exhibits E, F, & G, in that order, appear in the pages following Exhibit G.

24 March 1965

EXHIBIT E
Page 2

PROJECTED SOURCE & APPLICATION OF FUNDS STATEMENT

EXHIBIT F

Demonstration Mine

	1965 (6 Mos.)	1966	1967	1968	1969	1970	1971	1972	1973	Notes
Funds Supplied By										
Net Income After Tax	- -	317,139	314,428	366,624	332,993	241,637	468,171	445,686	493,931	
Depreciation - Plant & Equipment	62,874	125,747	127,362	78,569	80,470	72,047	72,047	72,047	72,047	(1)
Depletion of Development	4,645	50,363	58,075	19,473	16,050	5,411	4,161	4,161	4,161	(2)
Increase in Accounts Payable	7,000	8,000	4,000	2,000	-	-	-	-	-	
Decrease in Accounts Receivable	-	-	-	-	-	15,000	-	-	-	
Total Funds Supplied	74,519	501,249	503,865	466,666	429,513	334,095	544,379	521,894	570,139	
Funds Applied To										
Additions to Plant & Equipment	-	-	405,800	64,000	-	-	-	-	-	(3)
Development	-	-	31,000	21,500	-	-	-	-	-	(3)
Net Loss from Operations	106,310	-	-	-	-	-	-	-	-	
Increase in Inventory	40,000	-	-	-	-	-	-	-	-	
Increase in Accounts Receivable	35,000	115,000	30,000	-	-	-	-	-	-	
Decrease in Accounts Payable	-	-	-	-	-	2,000	-	-	-	
Retirement 7 Yr. Debenture Notes	-	-	100,000	100,000	100,000	100,000	100,000	-	-	(4)
Dividends	-	-	31,250	31,250	31,250	31,250	31,250	31,250	31,250	(5)
Total Funds Applied	181,310	115,000	598,050	216,750	131,250	133,250	131,250	31,250	31,250	
Excess of Funds Supplied Over Funds Applied	(106,791)	386,249	(94,185)	249,916	298,263	200,845	413,129	490,644	538,889	
Cash - Beginning Balance	165,490	58,699	444,948	350,763	600,679	898,942	1,099,787	1,512,916	2,003,560	
Cash - Ending Balance	58,699	444,948	350,763	600,679	898,942	1,099,787	1,512,916	2,003,560	2,542,449	

Notes to Exhibits E, F, & G, in that order, appear in the pages following Exhibit G.

24 March 1965

EXHIBIT F

PROJECTED COMPARATIVE BALANCE SHEETS

EXHIBIT G

Demonstration Mine

	June 30	December 31									
	1965	1965	1966	1967	1968	1969	1970	1971	1972	1973	Notes
Assets											
Current Assets											
Cash	165,490	58,699	444,948	350,763	600,679	898,942	1,099,787	1,512,916	2,003,560	2,542,449	(4)
Accounts Receivable	-	35,000	150,000	180,000	180,000	180,000	165,000	165,000	165,000	165,000	(5)
Inventory - Spare Parts & Replacement Units	10,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	(6)
Total Current Assets	175,490	143,699	644,948	580,763	830,679	1,128,942	1,314,787	1,727,916	2,218,560	2,757,449	
Fixed & Other Assets											
Plant & Equipment (At Cost)	293,410	293,410	293,410	405,800	469,800	431,900	431,900	431,900	431,900	431,900)	
Accumulated Depreciation	-	62,874	188,621	22,573	101,142	143,712	215,759	287,806	359,853	431,900)	(7)
Net of Depreciation	293,410	230,536	104,789	383,227	368,658	288,188	216,141	144,094	72,047	-)	
Development - Net of Depletion	114,000	109,355	38,992	31,917	33,944	17,894	12,483	8,322	4,161	-	(8)
Recoverable Deposits	40,900	40,900	40,900	40,900	40,900	40,900	40,900	40,900	40,900	40,900	(9)
Organization Expense	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	(10)
Total Fixed & Other Assets	449,510	381,991	205,881	457,244	444,702	348,182	270,724	194,516	118,308	42,100	
Total Assets	625,000	525,690	850,829	1,038,007	1,275,381	1,477,124	1,585,511	1,922,432	2,336,868	2,799,549	
Liabilities & Stockholders Equity											
Current Liabilities											
Accounts Payable	-	7,000	15,000	19,000	21,000	21,000	19,000	19,000	19,000	19,000	(11)
Current Maturity - 7 Yr. Debenture Notes	-	-	100,000	100,000	100,000	100,000	100,000	-	-	-	(12)
Total Current Liabilities	-	7,000	115,000	119,000	121,000	121,000	119,000	19,000	19,000	19,000	
Long-Term Liabilities											
7 Year 8% Debenture Notes - Less Current Maturity	500,000	500,000	400,000	300,000	200,000	100,000	-	-	-	-	(12)
Total Liabilities	500,000	507,000	515,000	419,000	321,000	221,000	119,000	19,000	19,000	19,000	
Stockholders Equity											
Capital Stock	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	125,000	(13)
Retained Earnings	-	(106,310)	210,829	494,007	829,381	1,131,124	1,341,511	1,778,432	2,192,868	2,655,549	
Total Stockholders Equity	125,000	18,690	335,829	619,007	954,381	1,256,124	1,466,511	1,903,432	2,317,868	2,780,549	(13)
Total Liabilities & Stockholders Equity	625,000	525,690	850,829	1,038,007	1,275,381	1,477,124	1,585,511	1,922,432	2,336,868	2,799,549	
	Note (2)						Note (3)			General Note	(1)

Notes to Exhibits E, F, & G, in that order, appear in the pages following Exhibit G.

24 March 1965

EXHIBIT G

Projected Comparative Statement
of Income and Retained Earnings

Demonstration Mine

Notes

(1) General Note. The production, sales and expense figures appearing in this Statement have been taken or derived from other exhibits of this Supplement, notably Exhibits B, C, and D, or from the Feasibility Study. These sources are cited, where appropriate, in the Notes to the Statement.

Figures have been carried out to the last dollar as a matter of convenience in proving computations. Extraordinary precision of projection is not implied. A column containing totals for the 8½ year operating period has been included to permit the operation of the Demonstration Mine to be viewed as a whole.

(2) Coal Production. Production tonnages shown here are taken from Exhibit D, Timetable of Projected Operations and Production.

(3) Coal Purchased and Purchased Coal. It is projected that strip coal will be purchased, from others working the upper coal seams on the same property, at a price of $3.30 per ton, on the following basis:

Period	Average Tons Per Working Day Clean Coal Basis
1965	150
January-February 1966	200
March 1966 onward	300*

* Refer Feasibility Study, page 49, paragraph 2.

(4) Coal Shipped. No appreciable storage of coal is contemplated. Shipments account for all coal produced and purchased.

(5) Coal Sales. Coal shipments, shown in the preceding line, sold at a price of $4.10 per ton, produce Coal Sales in the amounts listed. At $4.10 per ton C-prime coal is competitive with residual oil on the Eastern Seaboard. Refer Feasibility Study, pages 62 and 63.

Notes

(6) Sales Commission. It is proposed that a sales commission amounting to 5½% of coal sales be paid to the selling agency handling the sale of coal. Refer Exhibit C, Section II, Overhead Expense.

(7) Labor and Fringe Benefits. Labor costs shown in this statement have been obtained by the separate computation of the labor cost of the coal produced by each of the operations set forth in Exhibit D, Timetable of Projected Operations and Production, at the unit labor cost specified for each operation in the table of Operating Expense Rates contained in page 3 of Exhibit C, and the summation by years of the separately computed costs. For the elements which make up labor cost refer Feasibility Study, page 49, Labor and Associated Expenses.

(8) Supplies. A list of the items of expense which make up the cost of supplies is displayed in the tabulation of Estimated Costs Per Ton contained in page 49 of the Feasibility Study. Supply costs shown in this Statement have been computed and summed using the data of Exhibits C and D in the same manner as for labor costs. Refer Note 7 above.

(9) Trucking. Surface transport by truck of coal from mine to shipping point is projected for operations in Areas 2 and 3. Trucking costs shown are based on unit costs displayed in page 3 of Exhibit C.

(10) Deferred Operating Expense. Deferred Operating Expense as used here refers to substantial periodic expenditures, over and above the expense of routine maintenance and repair, for major overhaul, rebuilding, parts renewals, and moving of underground equipment. The nature of the expenditures and their different timing for different kinds of equipment are set forth in the schedule of Overhead Expense and Footnotes (1)-(5) thereto appearing in page 50 of the Feasibility Study.

This Income Statement shows the yearly totals of such expenditures taken as they are projected to occur. The totals vary widely from year to year for the reason that individual expenditures for the several kinds of equipment differ both in size and in frequency of occurrence. Refer Exhibit C, Section II, Overhead Expense, for discussion of Deferred Operating Expense.

(11) Depletion of Development. Refer Exhibit G, Note 8, wherein the makeup of Development Costs totalling $166,500 is set forth and referenced and the basis for Depletion charges is stated. It will be noted

Notes

(11) (Continued)

that the total amount of Depletion charges appearing in the Income Statement is $166,500.

(12) Depreciation-Plant & Equipment. A statement of investments, totalling $763,210, made in Plant & Equipment, and the periods of time over which the various portions of the resulting assets are to be depreciated, are set forth and referenced in Exhibit G, Note 7. Corresponding Depreciation charges are shown in the Income Statement. With the final depreciation charge shown in 1973 all Plant & Equipment will have been fully depreciated. All depreciation is on a straight line basis over the time periods involved. It will be noted that the total amount of Depreciation charges appearing in the Income Statement is $763,210.

(13) Leased Equipment-Rental. Monthly rental payments on account of principal (but not including interest), timed according to the periods of principal reduction projected for the three groups of leased equipment make up the annual amounts shown as Leased Equipment-Rental, in the Income Statements. The total of such amounts during the operating period is $1,206,855. Refer schedule of Lease Projections, Exhibit B, page 7, and Exhibit C, page 5.

(14) Leased Equipment-Interest. Carrying charges (Interest) on leased equipment are projected to begin according to the following schedule of equipment deliveries. The amounts shown in the schedule are the accumulated deliveries as of each month for each lease.

Month in Which Interest Is Payable	Amount of Principal - Cost of Equipment Delivered		
	Surface Equipment	Underground Equipment	Longwall Equipment
May 1965	$ 17,900	-	-
June 1965	100,040	$ 7,400	-
July 1965	108,775	34,390	-
August 1965	108,775	236,152	-
September 1965	117,775*	238,652	-
October 1965	-	312,202	-
November 1965	-	312,202	-
December 1965	-	325,670*	-
January 1966	-		$763,410*

* Full amount of Lease, delivery completed.

Notes

(14) (Continued)

Monthly interest payments, at an annual rate of 5% on the principal amounts shown during the delivery periods and thereafter on the full amount of each lease to the end of the lease period, make up the annual amounts, shown as Leased Equipment-Interest, which appear in the Income Statement.

Refer schedule of Lease Projections, Exhibit B, page 7, and related discussion.

(15) Coal Royalty. Royalty payments, at a rate of $0.200 per ton of coal produced, according to the terms of the coal lease, are shown as annual amounts in the Income Statement. Refer Feasibility Study, Overhead Expense, page 50.

(16) Insurance-Plant & Equipment. Annual insurance cost is projected on the basis of the unit rates set forth in the Feasibility Study, Overhead Expense, page 50, and the operations listed in Exhibit D of this Supplement.

(17) Interest-Debenture Notes. Interest on the Seven Year 8% Debenture Notes is projected in accordance with the date of issue and the retirement schedule appearing in Note 12 to Exhibit G, Balance Sheets.

(18) Taxes on Improvements (Buildings). Annual taxes of this character are projected on the basis set forth in Exhibit C, Section II, Overhead Expense.

(19) Surface Rental. Annual surface rental is projected at a rate of $50 per month during the construction and operating periods shown in Exhibit D of this Supplement.

(20) Association Dues. Dues for membership in the Central Pennsylvania Coal Producers Association are projected at a rate of $0.004 per ton of coal produced. Refer Exhibit C, Section II, Overhead Expense.

(21) Administration. Administration Expense is projected on the basis of rates set forth in the Feasibility Study, Overhead Expense, page 50, beginning with March 1966; with some upward adjustment of rates for the period July 1965-February 1966. Refer Exhibit C, Section II, Overhead Expense.

Notes

(21) (Continued)

Administration includes:
Salaries-Officers
Salaries-Purchasing, Stenographic, 50% of Engineering
Office Rent, Utilities and Telephone
Stationery and Printing
Travel Expense
Contributions
Directors Fees and Expenses
Janitor Service

(22) Dividends Paid. It is projected that cash dividends at an annual rate of 25% on Capital Stock will be paid in 1967 and later years.

(23) Income Deductions and Tax Incidence. Permissible deductions and allowances for Federal income tax purposes are Loss Carry Forward and Depletion Allowance. In the Income Statement operating loss from 1965 is taken as a deduction in 1966. Depletion Allowance is taken in 1966 and later years.

Depletion Allowance is defined as an amount equal to 10% of Gross Sales of coal produced but not more than 50% of Net Income Before Tax.

In order to exhibit the basis on which the Applicable Depletion Allowance is taken the following have been included in the Statement:

Gross Sales of Coal Produced computed at a price of $4.10, purchased coal excluded.

A - 10% of Gross Sales of Coal Produced (As above)
B - 50% of Net Income (Before tax).

As indicated by asterisks (*) "B" is the limiting amount for the years 1966-70 and "A" for the years 1971-73.

Federal income tax rates for 1965 are: 22% on the first $25,000 and 28% on the balance of taxable income. Federal Income Tax has been computed at these rates on the amounts shown as Income Subject to Federal Income Tax.

(24) Pennsylvania Income Taxes. Pennsylvania Income Tax is computed at a rate of 6% on the amounts shown as Net Income (i.e., Net Income before Tax). Previous losses are not deductible.

Projected Source & Application of Funds Statement

Demonstration Mine

Notes

(1) Depreciation-Plant & Equipment. Refer Exhibit E, Note 12, and Exhibit G, Note 7.

(2) Depletion of Development. Refer Exhibit E, Note 11, and Exhibit G, Note 8.

(3) Additions to Plant & Equipment and Development. Refer Exhibit B, Page 6, Additional Capital Investment-Areas 2 & 3.

(4) Retirement 7 Year Debenture Notes. Refer Exhibit G, Note 12.

(5) Dividends. Refer Exhibit E, Note 22.

Projected Comparative Balance Sheets

Demonstration Mine

Notes

(1) General Note

(a) It is intended that these projections shall be conservative. For simplicity they are made on the premise that operations of the Demonstration Mine will be conducted on a current cash basis with respect to all operating and overhead expenses, taxes and related obligations, these being met as they arise without prepayment or accrual. Thereby the usual array of prepaid and accrued utems is eliminated from the balance sheets. Such items convey no essential information about an enterprise unless the accruals are so large relatively as to suggest financial difficulty.

As compared with a balance sheet in which these items appear their elimination has the following effect. Current assets and current liabilities are somewhat reduced - both to the same extent. Net working capital is unchanged. If, as is usually true, the accrued obligations exceed the prepaid items the cash balance is reduced by the amount of such excess. Other accounts are not affected.

The simplified balance sheets do not render the projections less conservative than if made on an accrual basis. To the extent that projected cash balances are reduced when operations are put on a cash basis, the projections are made more conservative.

(b) These projections are concerned with the Demonstration Mine up to the conclusion of operations in Area 3. Since no forecast is made of the course to be taken by the operating company beyond that time the projections terminate with the condition existing at the end of 1973 prior to any change that might then occur.

(2) Balance Sheet at June 30, 1965. The Balance Sheet at June 30, 1965 displays, with some approximation, the condition of the mining enterprise just prior to the beginning of Butt Entry Development operations in Area 1. The condition shown is that which would exist if all construction and development work were completed. According to operating projections the construction would not be entirely completed for another two months (Refer Feasibility Study, page 50, last paragraph) and some $25,000 of Development expenditure would remain to be made in January and

Notes

(2) (Continued)

February 1966. (Refer Feasibility Study, last item on page 58 - Development). This approximation is made in order to bring the figures showing available capital and the initial expenditure thereof together in a single statement uncomplicated by operating results.

For detail on particular items refer to notes listed in the column to the right of the 1973 Balance Sheet.

(3) Balance Sheet at December 31, 1970. The 1970 Balance Sheet reflects only 11 months of mining operation. Operations will be suspended one month to allow overhaul of Longwall Roof Supports. (Refer Exhibit D).

(4) Cash. The cash balance shown at June 30, 1965 is the residue of initial capital after investment in the other assets listed. The capital structure has been proportioned to allow a fund of this magnitude to provide working capital during the period in which operations will be conducted at a loss, with some margin of safety.

Beginning in 1966 operations would become sufficiently profitable to meet requirements for increased working capital, provide for debt service, and generate additional cash in excess of the amount that would be required for carrying on operations. It is beyond the scope of these projections to forecast the disposition of excess cash. Therefore it appears as an accumulation in the cash account.

(5) Accounts Receivable. Accounts Receivable are projected on the basis of an average age of approximately 20 days, coal sales considered.

(6) Inventory.

(a) The omission of a coal inventory is intentional. No stockpiling of coal is contemplated. Operations as projected would limit the coal on hand to the content of the 800 ton raw coal silo ahead of the cleaning plant and such clean coal as had accumulated for the next shipment. The total could approximate 5,000 tons at maximum, approach zero at minimum, and would be subject to rapid fluctuation. It is disregarded in these projections.

(b) The small initial inventory of Spare Parts & Replacement Units is adequate for the routine maintenance and

Notes

(6) (Continued)

repair of the development equipment which would operate during 1965 operations. For 1966 and later years it is increased to accommodate longwall equipment as well. The inventory shown does not provide for major replacements that are periodically required by several types of equipment. Materials for such purposes would be purchased as and when required for each such occurrence.

(7) Plant & Equipment. The amounts shown as Plant & Equipment (At Cost) have been adjusted to reflect additions due to further investment and deletion of those assets which become fully depreciated prior to 1973. Those remaining on record at the end of 1969 become fully depreciated as of December 31, 1973 but are not deleted. Accumulated Depreciation has also been adjusted to match the deletion of assets. Adjustments are as follows:

	Plant and Equipment	Accumulated Depreciation
Balance Sheet December 31,1966	293,410(i)	188,621
Additions - 1967	367,900(ii)	127,362
	37,900(iii)	-
	699,210	315,983
Deletions - 1967	293,410(i)	293,410
Balance Sheet December 31,1967	405,800	22,573
Additions - 1968	64,000(iv)	78,569
Balance Sheet December 31,1968	469,800	101,142
Additions - 1969	-	80,470
	469,800	181,612
Deletions - 1969	37,900(iii)	37,900
Balance Sheet December 31,1969	431,900(v)	143,712

(i) Original Plant & Equipment-Area 1, Fully depreciated October 31, 1967. Refer Analysis of Initial Cash Investment, Exhibit B, page 5.

(ii) Plant & Equipment-Area 2. Also used for Area 3. Remains in use through 1973. Refer Additional Capital Investment, Area 2, Total (b), Exhibit B, page 6.

(iii) Plant & Equipment-Area 2. Fully depreciated June 30, 1969. Refer Additional Capital Investment, Area 2, Total (a), Exhibit B, page 6.

(iv) Plant & Equipment-Area 3. Remains in use through 1973. Refer Additional Capital Investment, Area 3, Exhibit B, page 6.

Notes

(7) (Continued)

(v) Consists of (ii) and (iv).

Annual Depreciation charges are shown and noted in the Income Statements of Exhibit E.

(8) Development-Net of Depletion. Expenditures for the work and services termed Development constitute investment made in anticipation of and necessary for the extraction of coal from a property. Development expenditures are capitalized when made and written off over the operating life of the property by means of Depletion charges to overhead expense.

Initial and later expenditures for Development, detailed in the references, are:

	Development	Reference
Initial Cash Investment	$114,000	(a)
Additional Investment-Area 2	31,000	(b)
Additional Investment-Area 3	21,500	(b)
Total	$166,500	

References

(a) Analysis of Initial Cash Investment, Exhibit B, page 5.

(b) Additional Capital Investment-Areas 2 and 3, Exhibit B, page 6.

The initial investment appears in the Balance Sheet of June 30, 1965. Amounts shown at December 31, 1965 and for later years are the undepleted year-end Development balances which are equal to: (Total Investment in Development to date) minus (Accumulated Depletion to date). The Additional Investments for Areas 1 and 2, projected as occurring in April 1967 and November 1968 respectively, have been added as of the date of occurrence to the then existing undepleted balance. Annual Depletion charges are shown and noted in the Income Statements of Exhibit E.

(9) Recoverable Deposits. A list of these deposits appears as Analysis of Recoverable Deposits in page 4 of Exhibit B with references indicating their purposes. The deposits are recoverable either by refund at the conclusion of operations or in the form of credits applicable to coal royalty payments in the last months of operations.

Notes

(10) Organization Expense. Organization Expense is the estimated cost of establishing a new corporate entity to operate the Demonstration Mine. Refer Exhibit B-Additions Included in Revised Investment Summary.

Accounting practice admits either the writing off to operations or the retention of such an expense in the balance sheet. It has been retained.

(11) Accounts Payable. Accounts Payable are projected on the basis of an average age of approximately 10 days for purchases of coal and supplies.

(12) Debenture Notes. It is projected that $500,000 of capital would be raised through the sale of Seven Year 8% Debenture Notes, retirement to begin after two years, with the right of anticipation of scheduled retirement retained. Date of issue has been taken as April 1, 1965. Retirement is projected at the rate of $100,000 on April 1 of each year beginning in 1967.

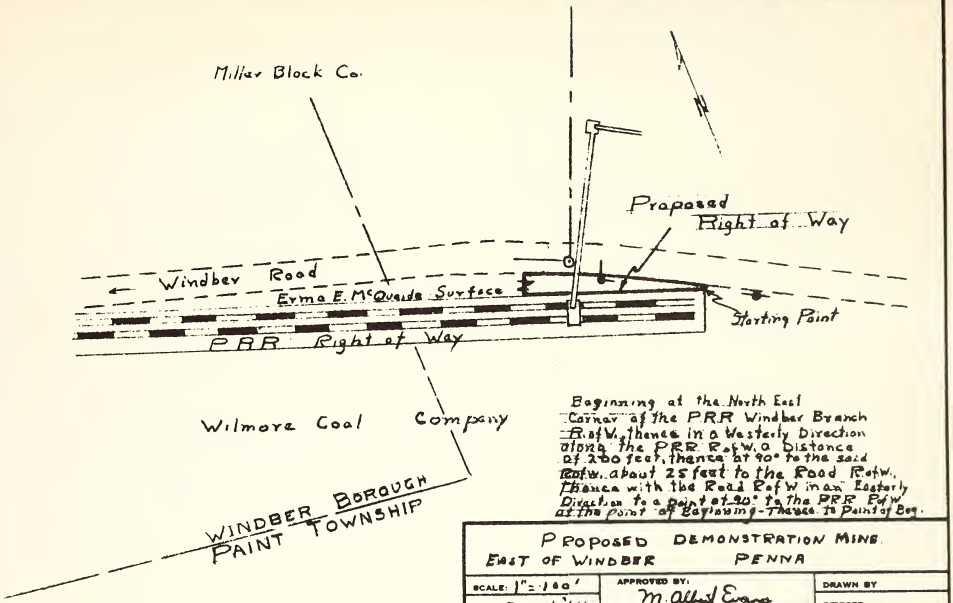
(13) Capital Stock and Stockholders Equity. Common Stock, issued and paid up at April 1, 1967, is shown as remaining unchanged during the period of projected operations. Stockholders Equity, aside from Retained Earnings, is predicated on the retirement of Debenture Notes by cash payment according to schedule. Cash, capital stock and equity would become subject to adjustment in the event that notes might be exchanged for stock.

DRAWINGS

Proposed Demonstration Mine

East of Windber, Pennsylvania

Number	Title
A- 1-32	Right of Way Across McQuaide Surface
B- 6-11	Equipment Detail - Head Stable
B- 6-12	Equipment Detail - Tail Stable
C-10-25	General Flow Diagram
C-10-32	Surface Plant Layout Showing Proposed Siding Extension
C-10-33	Strata and Seam Data
C-10-34	Projection - C' Seam
C-10-35	Underground Equipment
C-10-38	Mining Plan
C-10-39	Surface Layout



Beginning at the North East Corner of the PRR Windber Branch R of W, thence in a Westerly Direction along the PRR R of W a distance of 200 feet, thence at 90° to the said R of W, about 25 feet to the Road R of W, Thence with the Road R of W in an Easterly Direction to a point at 90° to the PRR R of W at the point of Beginning - Thence to Point of Beg.

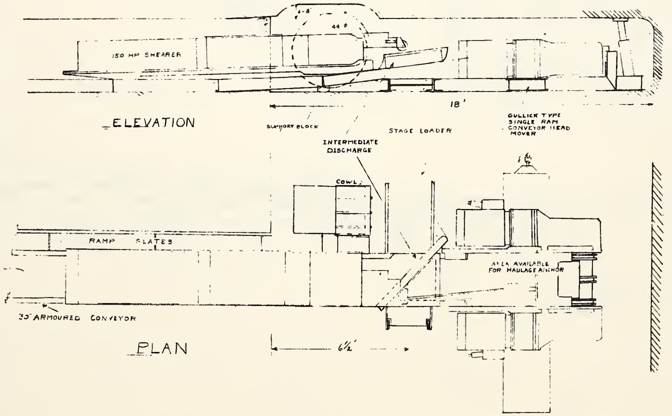
PROPOSED DEMONSTRATION MINE
EAST OF WINDBER PENNA

SCALE: 1" = 100'	APPROVED BY: M. Albert Evans	DRAWN BY
DATE: June 11, '64		REVISED

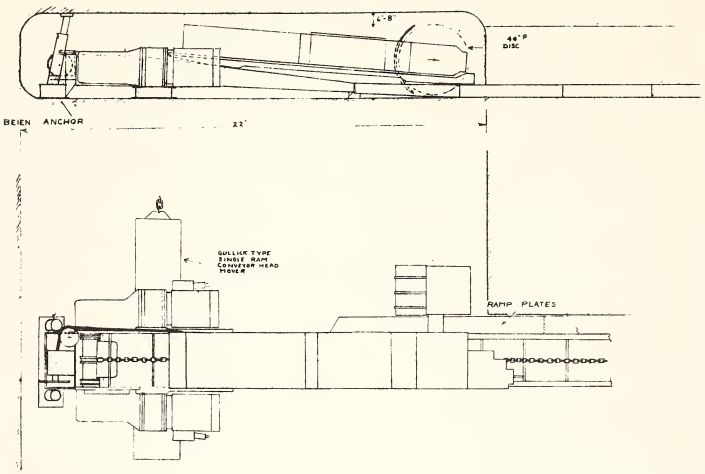
RIGHT OF WAY ACROSS McQUAIDE SURFACE

ALLISON L BAYLES & ASSOCIATES
PITTSBURGH PENNA

DRAWING NUMBER A-1-32



PROPOSED DEMONSTRATION MINE EAST OF WINDBER PENNA.		
SCALE: ½" = 1 Foot DATE: July 24, 1964	APPROVED BY: M. Albert Evans	DRAWN BY REVISED Aug. 1964
EQUIPMENT DETAIL-HEAD STABLE		
ALLISON L. BAYLES & ASSOCIATES PITTSBURGH PENNA.		DRAWING NUMBER B-6-11

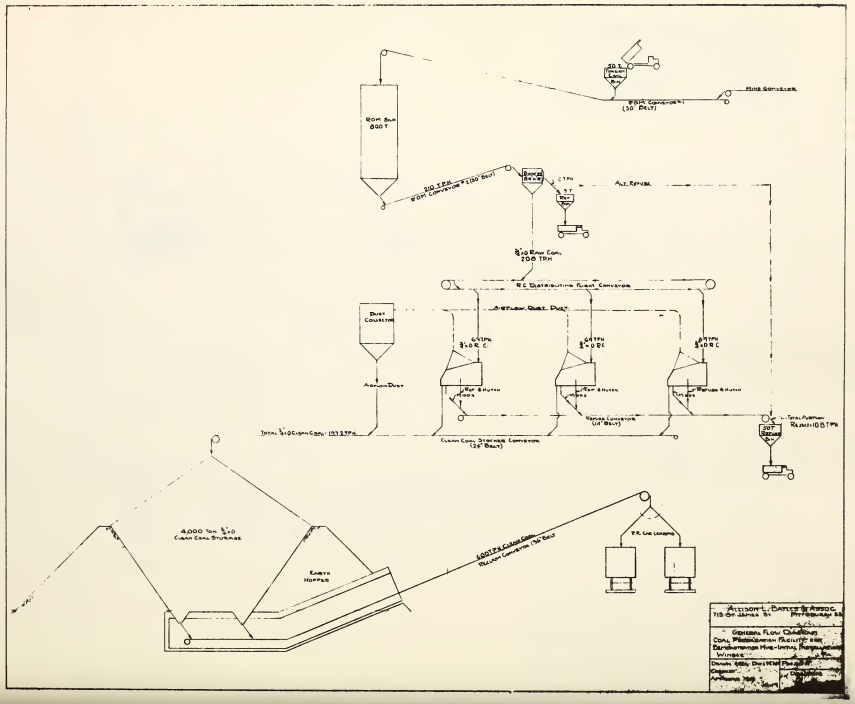


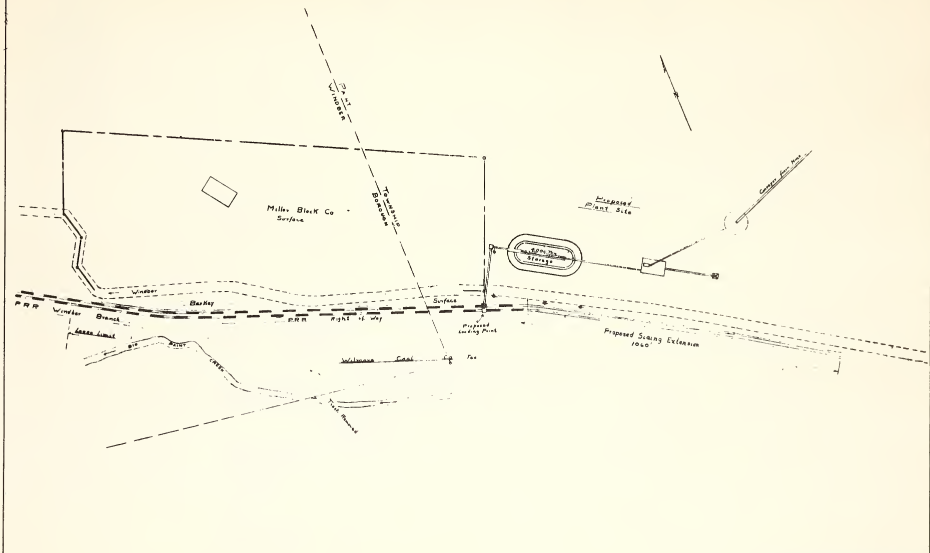
PROPOSED DEMONSTRATION MINE
EAST OF WINDBER PENNA.
SCALE 3/4" = 1 FOOT
DRAWN BY M. Allred Evans
DATE JANUARY 1944
TRACED BY
CHECKED BY

EQUIPMENT DETAIL-TAIL STABLE

ALLISON L. BAYLES & ASSOCIATES
PITTSBURGH PENNA.

B-6-12


ROM Silo
800 T
FOR Conveyor #1
(30" Belt)
Mine Conveyor
210 TPH
FOR Conveyor #2 (30" Belt)
Alt. Refuse
2" x 0 Raw Coal
206 TPH
R.C. Distribution Flight Conveyor
Dust Collection
Overflow Coal Duty
Return Dust
Total 2"x0 Clean Coal 183.2 TPH
Clean Coal Storage Conveyor
(24" Belt)
Refuse Conveyor
(18" Belt)
Total Refuse
Reject 10.8 TPH
4,000 Ton 2"x0
Clean Coal Storage
Earth
Hopper
600 TPH Coal Coal
Railway Conveyor (36" Belt)
R.R. Car Loading



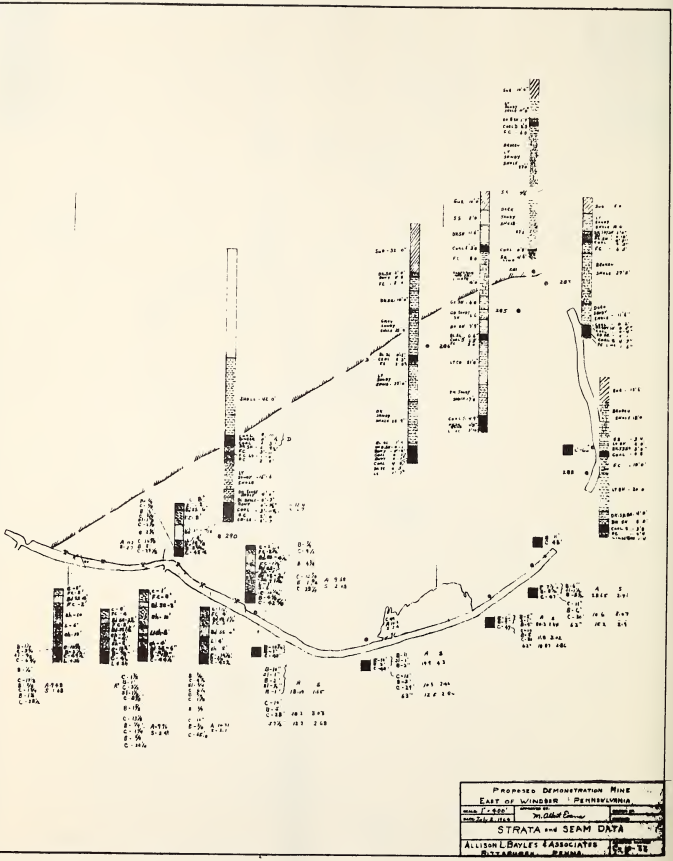
PROPOSED DEMONSTRATION MINE
EAST OF WINDBER, PENNSYLVANIA

SCALE 1" = 100'
DATE June 11 '46

SURFACE PLANT LAYOUT
SHOWING PROPOSED SIDING EXTENSION

ALLISON L. BAYLES & ASSOCIATES
PITTSBURGH, PENNA.

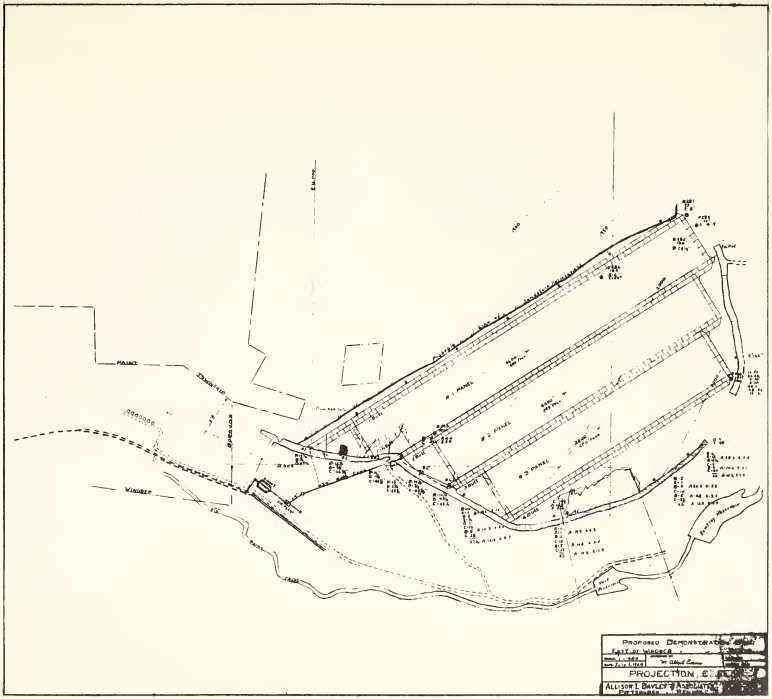
C-10-30

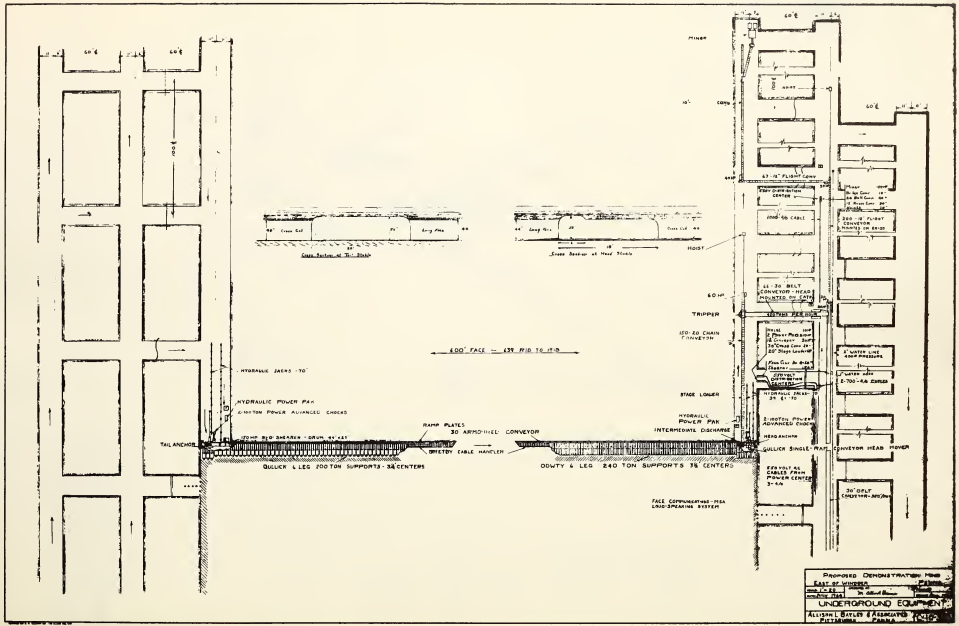


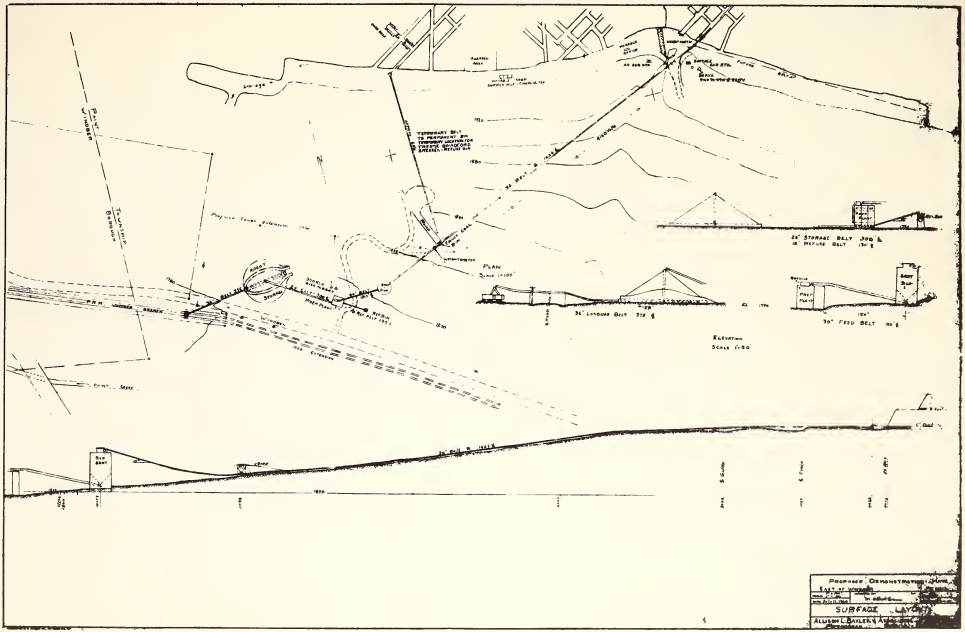
PROPOSED DEMONSTRATION MINE
EAST OF WINDBER : PENNSYLVANIA

STRATA and SEAM DATA

ALLISON L. BAYLES & ASSOCIATES
PITTSBURGH, PENNA.


PROPOSED DEMONSTRATION
EAST OF WARNER
PROJECTION SITE
ALLISON L. BAYLEY & ASSOCIATES


600' FACE — 439' MID TO MID
HYDRAULIC JACKS - 70'
HYDRAULIC POWER PAK
6-MOTOR POWER ADVANCED CHOCKS
TAILANCHOR
RAMP PLATES
30" ARMORFLEX CONVEYOR
SKETCH CABLE HANDLER
GULLICK 4 LEG 700 TON SUPPORTS - 36' CENTERS
DOWTY 4 LEG 240 TON SUPPORTS 36' CENTERS
HOIST
TRIPPER
STAGE LOADER
HYDRAULIC POWER PAK
INTERMEDIATE DISCHARGE
GULLICK SINGLE RAIL CONVEYOR HEAD MOTOR
FACE COMMUNICATIONS - MSA LOUD SPEAKING SYSTEM
PROPOSED DEMONSTRATION MINE
EAST OF VINCENNES
UNDERGROUND EQUIPMENT
ALLISON, BAYLES & ASSOCIATES
PICTORIAL


PROPOSED DEMONSTRATION PLANT
SURFACE LAYOUT
ALLISON L. BAILEY & ASSOCIATES